# INDIA RUBBER WORLD

JULY, 1948

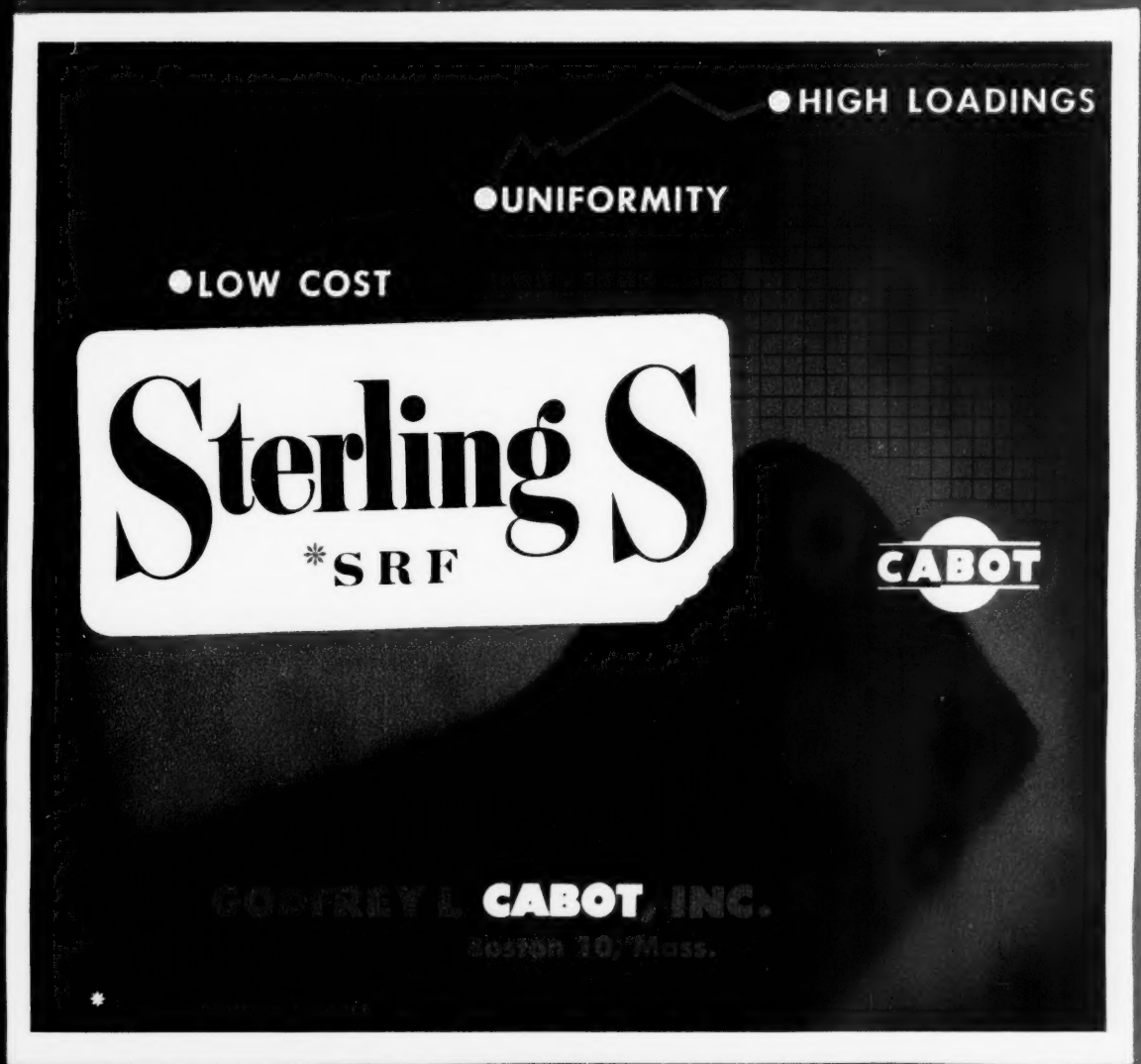
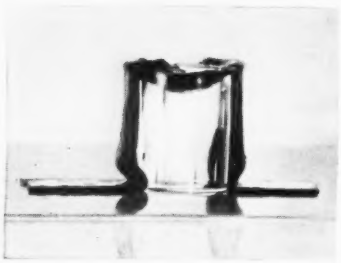



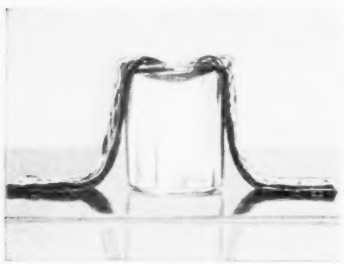
TABLE 1

| Compound | A | B | C |
|---|---|---|---|
| Neoprene GR-M-10 | 100.0 | 95.0 | 90.0 |
| Neoprene Type S | | 5.0 | 10.0 |
| NEOZONE D | 2.0 | 2.0 | 2.0 |
| HELIOZONE | 2.0 | 2.0 | 2.0 |
| Stearic Acid | 0.5 | 0.5 | 0.5 |
| Extra Light Calcined Magnesia | 4.0 | 4.0 | 4.0 |
| Fine Thermal Carbon Black | 10.0 | 10.0 | 10.0 |
| Light Process Oil | 15.0 | 15.0 | 15.0 |
| Sulphur | 1.0 | 1.0 | 1.0 |
| NA-11 | 1.0 | 1.0 | 1.0 |
| Zinc Oxide | 5.0 | 5.0 | 5.0 |



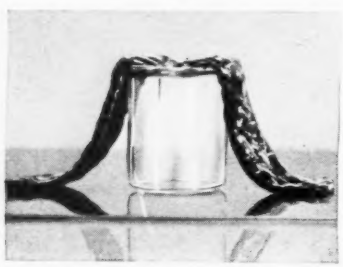
COMPOUND A

Neoprene GR-M-10 . . . . 100



COMPOUND B

Neoprene GR-M-10 . . . . 95
Neoprene Type S . . . . . 5



COMPOUND C

Neoprene GR-M-10 . . . . 90
Neoprene Type S . . . . . 10

## Improve processing of neoprene stocks with

# NEOPRENE Type S

- Produces firmer uncured stocks
- Reduces rate of mill breakdown
- Minimizes sticking to mill and calender rolls

There are many processing difficulties which can be overcome by the use of small amounts of Neoprene Type S. For example, the low durometer stock described in the table is extremely difficult to handle if GR-M-10 alone is used. But notice in the photographs how a small amount of Type S improves the stock. The compound is definitely firmer . . . shows less plastic flow. And no other changes are necessary in the formula because Type S does not change the properties of the vulcanizate.

The increased firmness of stocks containing Type S means less difficulty in mixing and calendering; reduces deformation of uncured molding slugs; produces higher back pressures in molding; makes possible the use of high softener ratios with fewer processing difficulties.

For suggestions and details on this use of Neoprene Type S, see Report BL-225, "Neoprene Type S as a Processing Aid in GR-M and GR-M-10 Compounds." Extra copies are available. Write to Rubber Chemicals Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

*Du Pont "CAVALCADE OF AMERICA" returns to the air Monday, September 13—NBC network*

DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

INDIA RUBBER WORLD, July, 1948, Vol. 118, No. 4, Published Monthly by BILL BROTHERS PUBLISHING CORP., Office of Publication, Orange, Conn., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second-Class Matter at the Post Office at Orange, Conn., under the act of March 3, 1879. Subscription United States and Mexico, $3.00 per year; Canada, $4.00; All Other Countries, $5.00; Single Copies 35 cents. Address Mail to New York Office.

# TWO NEW PLASTICIZERS FOR VINYL RESINS

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JUL 29 1948
DETROIT

## New Hycar Nitrile Polymers make processing easier and widen fields for makers of many products

THIS news is important to any company dealing in any way with the vinyl resins. The new Hycar EP (easy processing) and Hycar NS (easy-processing, non-staining) offer exceptional advantages. These are nitrile rubbers that really *blend* with the vinyls. Check these properties:

★ **PERMANENT CEMENTABILITY**—because these plasticizers are non-migrating and non-volatile. (Of vital interest to any manufacturer of products requiring cemented construction.)

★ **STABILITY**—won't get brittle, won't evaporate.

★ **NON-MIGRATING**—won't soften or pick up varnish.

★ **EASY PROCESSING**—and a more perfect blend either on a mill or in a Banbury. Calenders and extrudes *smoothly*.

★ **HIGHER LOADING**—economy in products where the price per pound of the compound is important.

★ **WIDER LATITUDE**—in color and color stability, particularly with those hard-to-do pastels.

Our service bulletin, 48-H1, on the use of the new Hycar American Rubber with the vinyl resins, will be sent on request. We make no finished products from Hycar or any of our other raw materials, but we are glad to help in the development work on any special applications. Write Dept. HA-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

**Hycar**
Reg. U.S. Pat. Off.
*American Rubber*

**B. F. Goodrich Chemical Company**
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# BUMPS MEAN NOTHING TO PHILBLACK O!

High abrasion resistance? You said it! Lower loadings with good physical properties? You betcha! Electrical conductivity? Good flex life? Now you're talking!... How do we know these things are true? These facts have been verified in the laboratory and in many road tests with various size tires. Prove them for yourself by ordering a trial-size quantity of this high abrasion furnace black for use in your own products.

**PHILLIPS PETROLEUM COMPANY**

*Rubber Chemicals Division*

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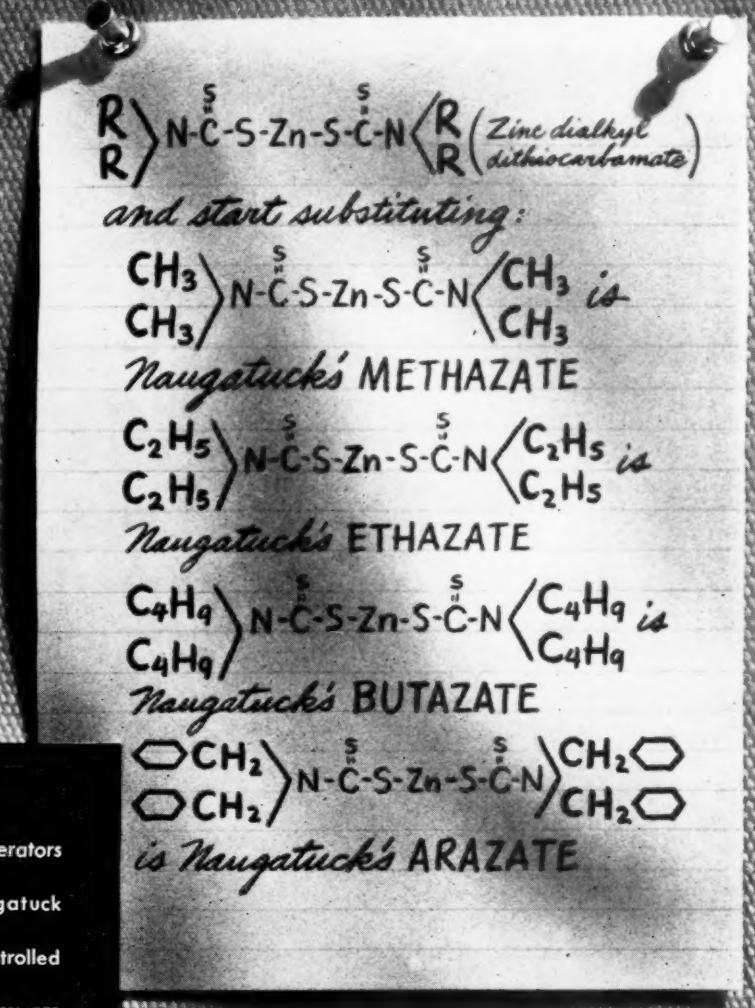
# TAKE A BASIC CHEMICAL STRUCTURE


R R N-C-S-Zn-S-C-N R R (Zinc dialkyl dithiocarbamate)
and start substituting:
CH3 CH3 N-C-S-Zn-S-C-N CH3 CH3 is
Naugatuck's METHAZATE
C2H5 C2H5 N-C-S-Zn-S-C-N C2H5 C2H5 is
Naugatuck's ETHAZATE
C4H9 C4H9 N-C-S-Zn-S-C-N C4H9 C4H9 is
Naugatuck's BUTAZATE
CH2 CH2 N-C-S-Zn-S-C-N CH2 CH2
is Naugatuck's ARAZATE

These "ultra" accelerators are made by Naugatuck Chemical under controlled process conditions. They are excellent for use as primary acceleration or as secondary with thiazoles.

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NOW AVAILABLE

# Polyvinyl Methyl Ether

## (PVM)

# In Pilot Plant Quantities

### You will find this New Polymer:

**I.** Is soluble in a wide variety of *organic solvents* as well as in *cold water.*

**II.** Precipitates out of water solutions in adhesive masses when heated to about 35°C and redissolves below that temperature without loss of original properties.

**III.** Is especially suitable as a non-ionic heat sensitizing agent for natural and synthetic latices.

**IV.** May be useful as a:

Tackifying agent for adhesives and cements.
Binding agent in textile, ceramic and paint fields.
Plasticizer for cellulose nitrate and chlorinated rubbers.
Special sizing agent for paper, textile and leather applications.
Auxiliary in tanning and pigment fields.

**V.** Is available in the following forms:

**a)** Unmodified PVM (highly viscous mass)
**b)** 80% PVM solution in water } for convenient dispersion
**c)** 50% PVM solution in water }

Technical information, price schedules and samples furnished upon request

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Good-rite
VULTROL
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to prevent scorching, and for recovering
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*For technical data please write Dept. CA-7*

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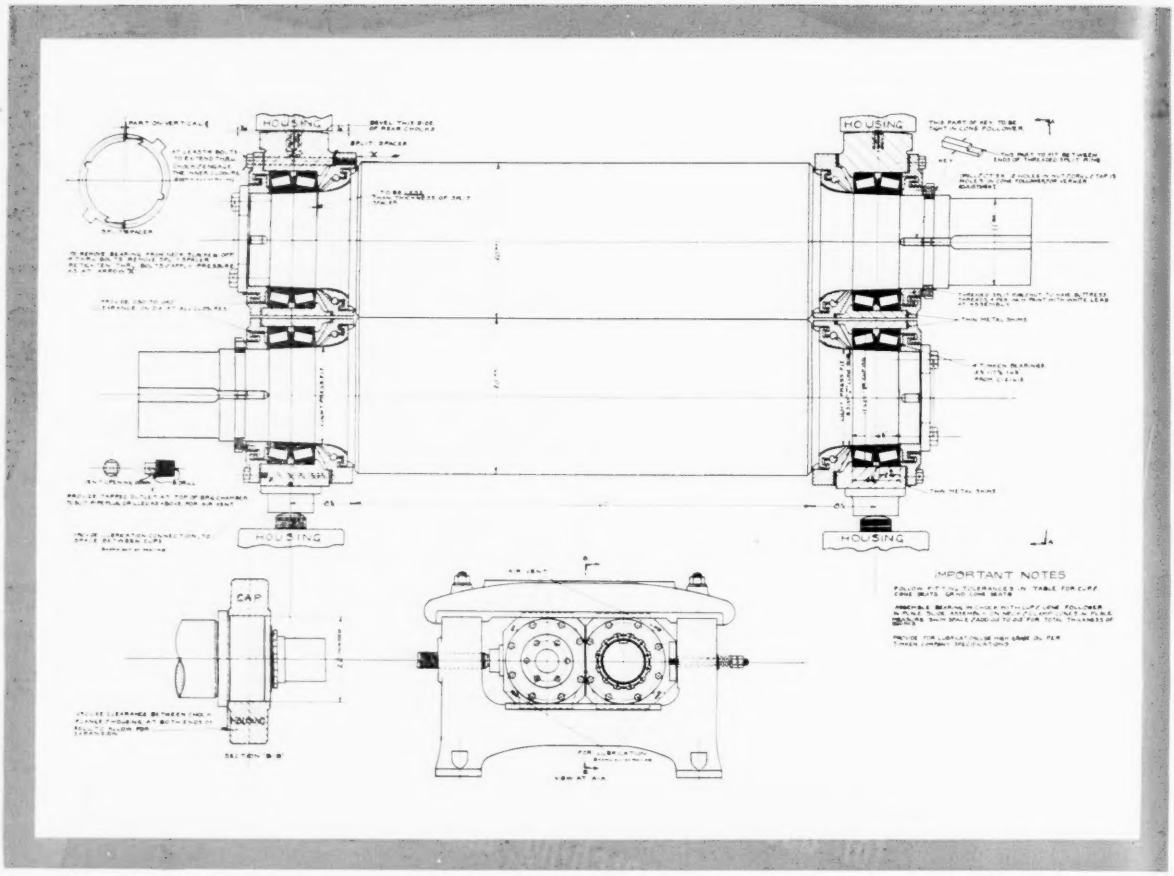
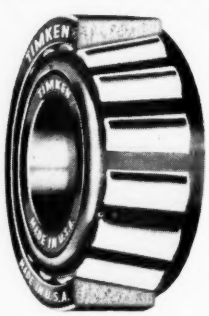
**GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals**




# How To Improve Rubber Mill Performance and Reduce Maintenance




Everything else being equal, rubber mills equipped with Timken Balanced Proportion Roller Bearings perform better, possess greater availability for service, last longer, cost less for operation and maintenance.

Mills have greater rigidity because Balanced Proportion bearings make possible larger roll neck diameters with 50% to 60% increased neck strength. Load ratings are higher, too — up to 40% higher than previous designs of tapered roller bearings, size for size.

A typical example of the application of Timken Balanced Proportion Bearings to rubber mill roll necks is shown in the drawing. There is a standardized application ready for your new or existing mills. Consult the mill builder or our engineers. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "TIMROSCO".

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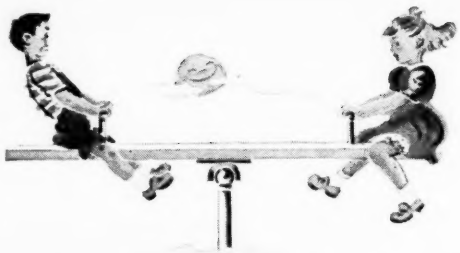
*TAPERED ROLLER BEARINGS*

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

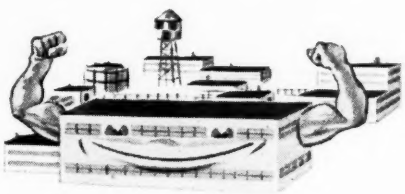


***Greater Stability!*** A polyvinyl chloride-type resin of high molecular weight, Marvinol offers superior resistance to heat, light and other normally destructive factors.

# MARVINOL® the new VINYL RESIN gives you all these advantages

***Broad Temperature Range!*** Products made from Marvinol resins show less heat deformation than other resins . . . offer positive advantages in low temperature flexibility.

***Unique Versatility!*** Easy to process, Marvinol resins may be calendered, extruded, injection molded, used in non-aqueous dispersions, formulated as unplasticized rigids. They're really versatile!



***Ultra-Modern Plant!*** New Marvinol plant contains latest equipment to assure efficient operation, uniform product, highest quality. Production quantities of Marvinol resins are now available.

***Close Cooperation!*** No division of The Glenn L. Martin Company compounds or fabricates in the plastics field. Let our sales engineers and modern customer service laboratory help solve your processing problems. Write on your company letterhead to: Chemicals Division, The Glenn L. Martin Company, Baltimore 3, Md.

***Other Advantages to Cheer About!*** Can give crystal-clear transparency, brilliant or delicate colors... unusual "dryness" . . . exceptional toughness and long life . . . may be tasteless, odorless . . . easily, quickly cleaned.

Martin® Marvinol

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF
THE GLENN L. MARTIN COMPANY • AN INTERNATIONAL INSTITUTION
"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"

DU PONT

# LUDOX®

Colloidal Silica

# ...increases bond strength of latex adhesives

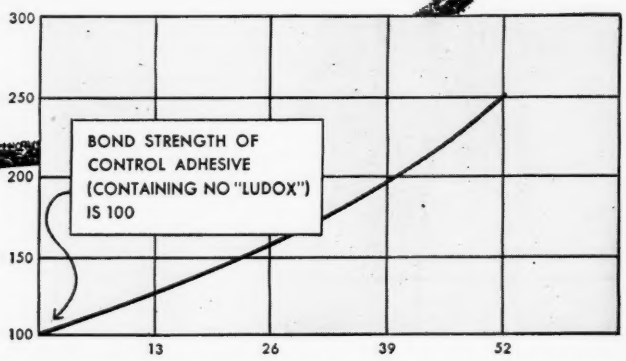



**CHART SHOWS STRENGTH** *increase obtained in leather to leather adhesion using a commercial, natural rubber latex adhesive, containing "Ludox."*

**Also** increases modulus and wear resistance of latex films and coatings

**NEW DU PONT "LUDOX"** now offers a means of increasing the bonding strength and versatility of your latex adhesives.

**"LUDOX" STRENGTHENS**—as much as two to three times—latex adhesion to a wide variety of surfaces . . . including fabric to fabric, leather to leather, and latex to metal. And, in many instances, it gives superior bonds where there is no adhesion with silica-free latex compositions.

## Improves Latex Films and Coatings

**"LUDOX"** improves wearing qualities by decreasing abrasion up to 50%. It also reduces water absorption and swelling of neoprene and it gives outstanding increases in the modulus of neoprene-dipped goods.

## New 30% Concentration Now Available

**"LUDOX"** is now available as a 30% aqueous, colloidal solution . . . highly fluid and substantially free of alkali.

**"LUDOX"** contains silica high in purity . . . chemically reactive and finely subdivided. The particle size is less than 1/1,000,000 of an inch.

## Technical Assistance

For further information on how "Ludox" can help you make better latex products, write or wire Du Pont today. A Du Pont technical representative will be glad to discuss with you the application of this new development to your own products.

DU PONT

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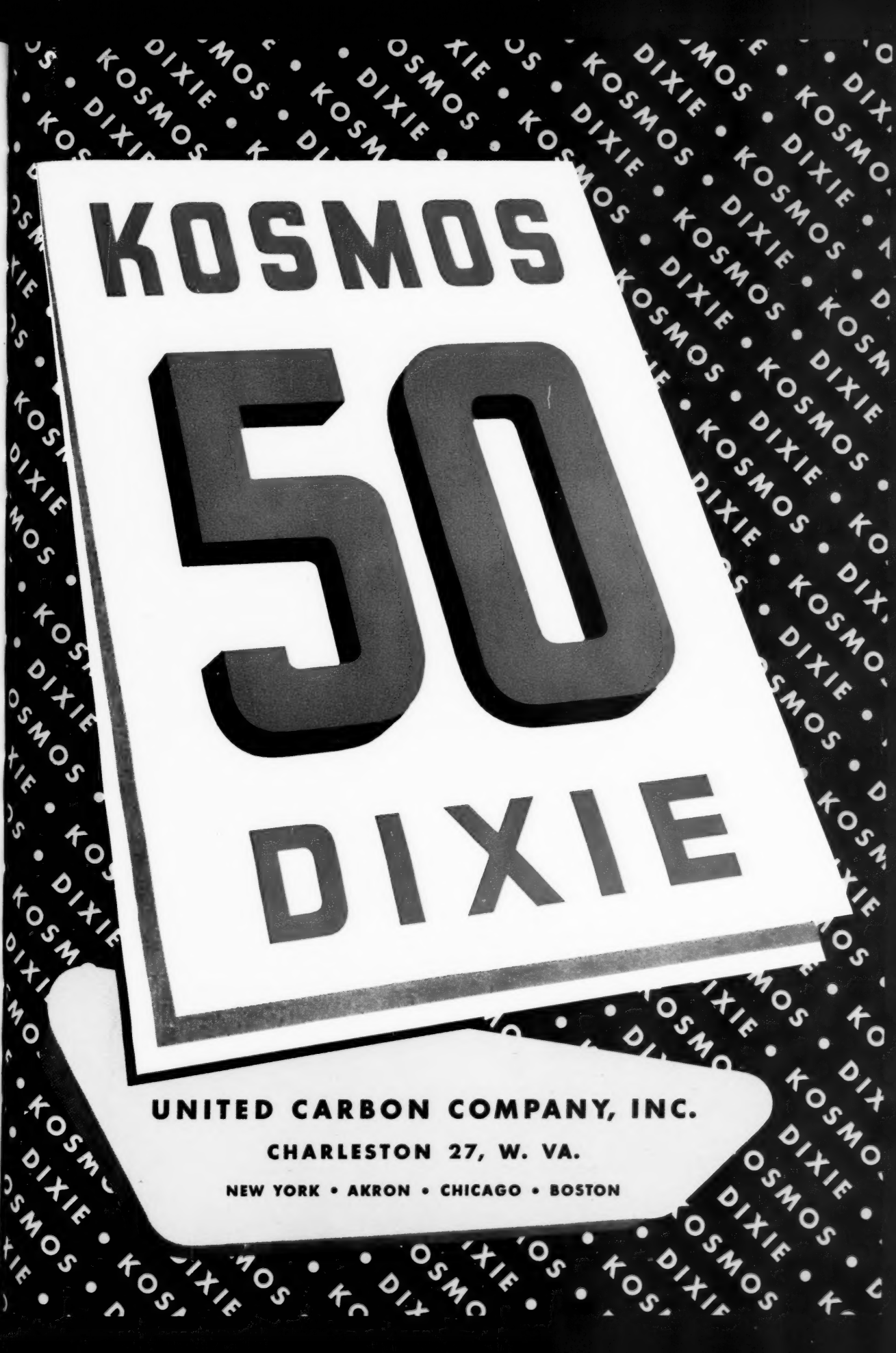
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

**E. I. du Pont de Nemours & Co. (Inc.),** ***Grasselli Chemicals Department, Wilmington 98, Delaware***


KOSMOS
50
DIXIE
UNITED CARBON COMPANY, INC.
CHARLESTON 27, W. VA.
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## KOSMOS 50—DIXIE 50 . . . . . .

a high modulus (HMF) furnace black characterized by structure and by a combination of most desirable properties for creating super-processing and high reinforcement.

## DIXIE 50—KOSMOS 50 . . . . . .

is made by a new United process in specially designed furnaces from carefully selected fuel. Every step during its manufacture is under stringent control and the black is outstandingly uniform in quality.

## KOSMOS 50—DIXIE 50 . . . . . .

is featured by ease of mixing, ready dispersion, fast extrusion, low shrinkage and finest appearance of stock. These are highly prized advantages.

## DIXIE 50—KOSMOS 50 . . . . . .

is a quick curing black yielding high modulus and tensile, high resistance to tear, abrasion and flex cracking, and high resilience. It ages well.

## KOSMOS 50—DIXIE 50 . . . . . .

Specify this black for tires, tubes, footwear, cable jackets and mechanical goods, and for blending with harder processing blacks.

*Excel by using Kosmos 50—Dixie 50*

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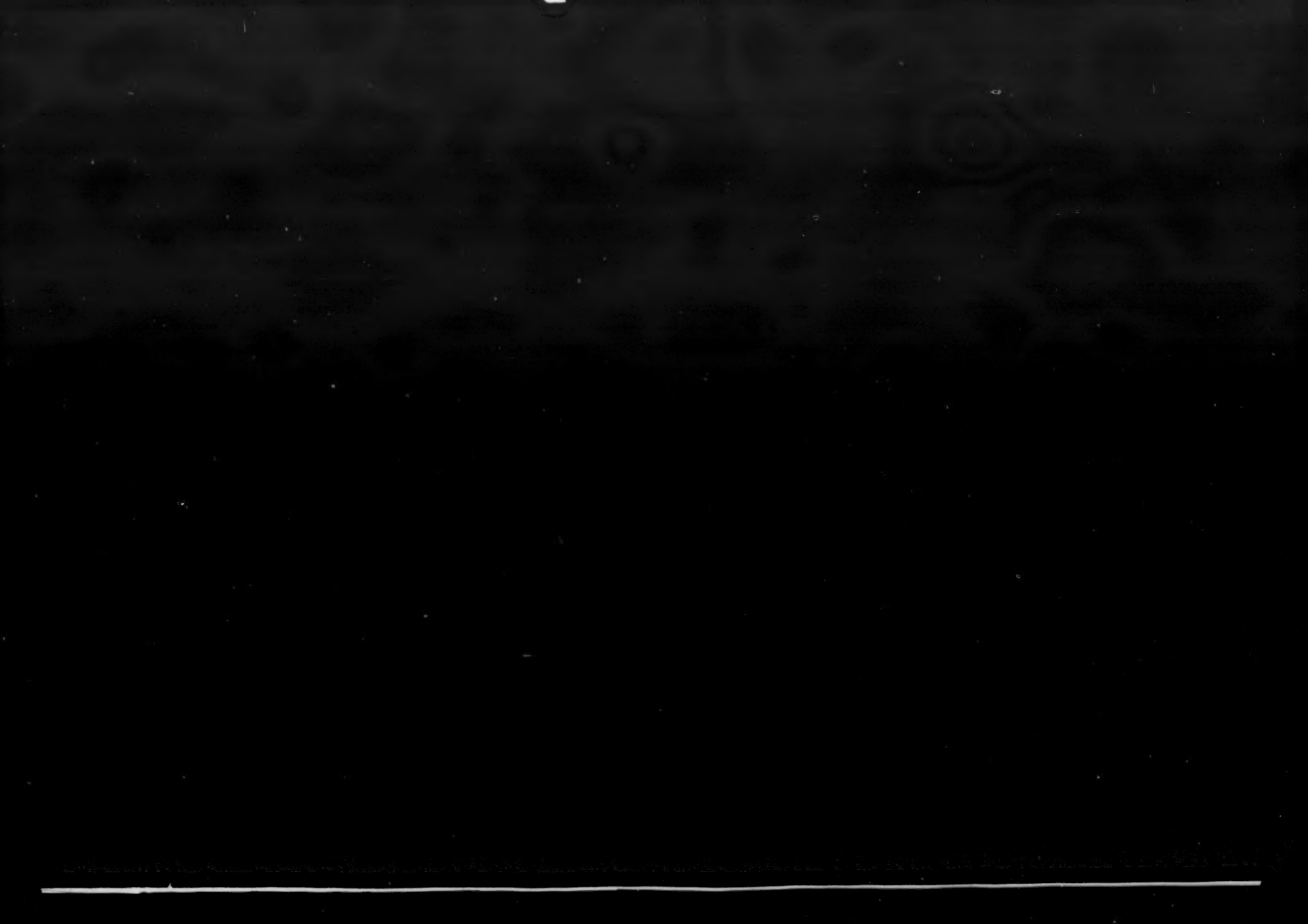
**UNITED CARBON COMPANY, INC.**

Charleston 27, West Virginia



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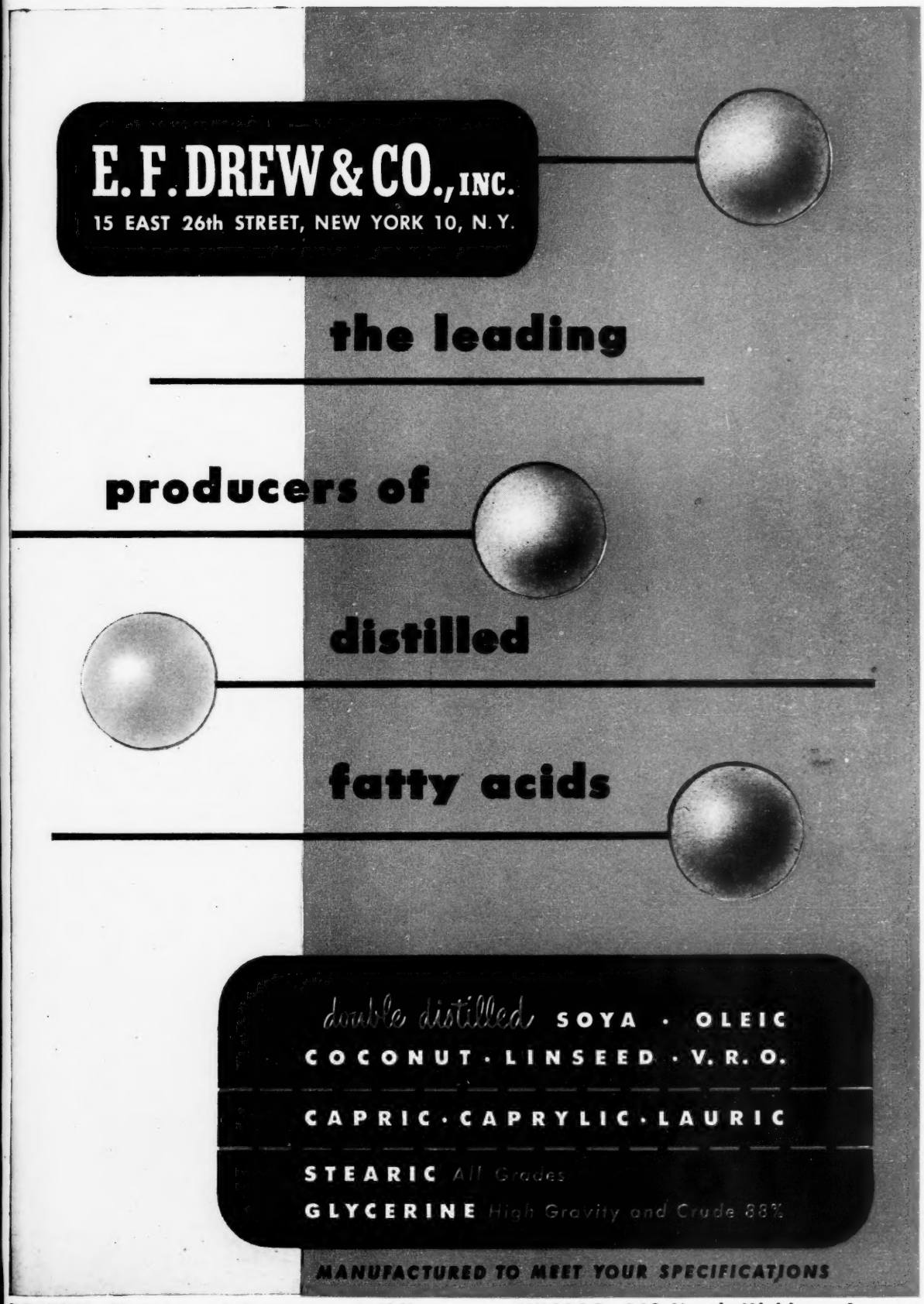
July,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15 EAST 26th STREET, NEW YORK 10, N. Y.
the leading
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STEARIC All Grades
GLYCERINE High Gravity and Crude 88%
MANUFACTURED TO MEET YOUR SPECIFICATIONS

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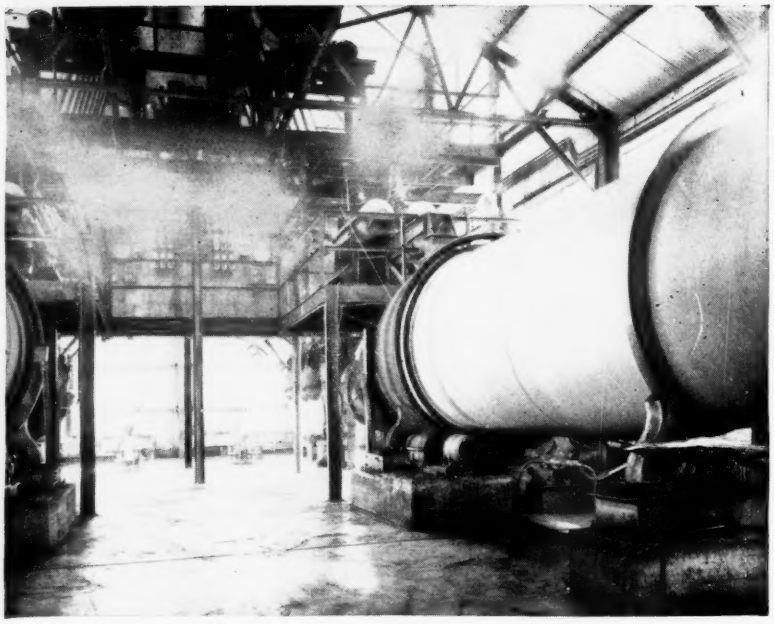
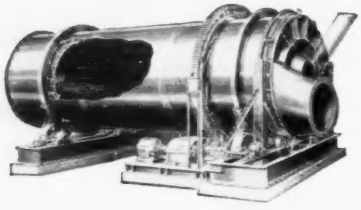
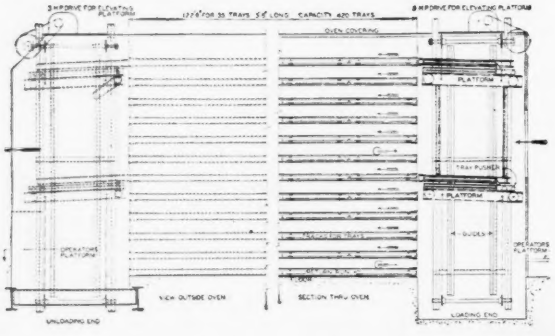
One of ten Link-Belt Roto-Louvre dryers handling pelletized carbon black at Cabot Carbon Co., Louisiana. After being moistened to the proper degree, the carbon black is gently agitated in the pelletizers shown above and at the far end of the large dryer. This causes the material to form small pellets. Passing through the Link-Belt Roto-Louvre dryer removes excess moisture while retaining the pellet form. Carbon black thus treated can be handled in a clean, convenient manner. Roto-Louvre dryers are described in detail in Book 1911-A. Link-Belt Company has also furnished an arrangement of rotating drums for pelletizing dry carbon black. Further details on request.





# Turn your DRYING PROBLEMS Over to LINK-BELT



Where the material to be dried must remain undisturbed during drying, the Link-Belt Multi-Tier dryer is recommended. The numerous loaded trays move slowly through the atmosphere of controlled temperature. Multi-Tier dryers are built to the Link-Belt standards of quality and service satisfaction. Send for engineering and application data.

● Handling carbon black is less of a nuisance since the development of the "pelletizing" process, the complete success of which depends upon the correct drying method. The Roto-Louvre dryer is especially suited to this purpose, as it exposes every particle of the treated material to the passage of heated air. It never "cascades" but gently turns the material on itself in a compact bed. The pellets of carbon black emerge dry, but intact, and in a condition to be handled without waste or dispersion.

Special advantages of the Roto-Louvre dryer are gentle handling, simplicity (there are no moving parts within the shell), longer service life, low maintenance costs. Floor area occupied is often less than half that needed by conventional drying equipment of comparable capacity. The control of temperature and moisture removal is simple and accurate.

Link-Belt engineers will gladly analyze your drying or cooling problems, and make recommendations based on wide experience and scientific laboratory tests.

**LINK-BELT COMPANY**

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

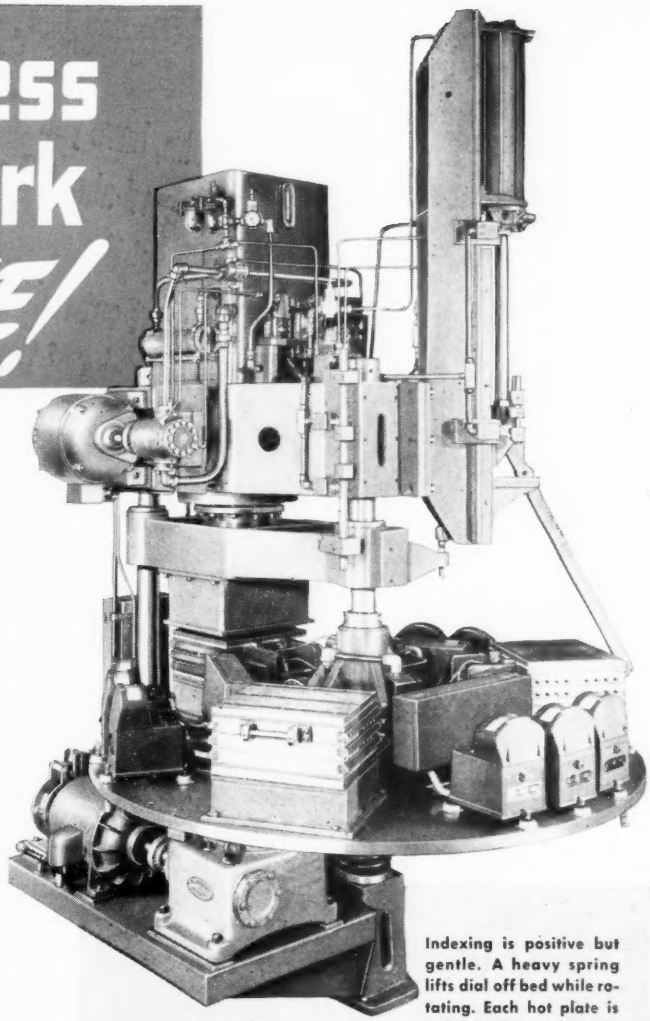
10,703

**LINK BELT**

THE SYMBOL OF QUALITY — LINK-BELT

**DRYERS AND COOLERS**
**DRYING PROCESS ENGINEERING**

# This *ONE* Press does the work of *THREE!*



**PROBLEM:** The molding-on of insulation, each mold to contain several pieces, all requiring wiping—and the mold to be thoroughly cleaned after each pressing. Handling and pre-heating took so much time that three presses of the *standard type* would have been needed.

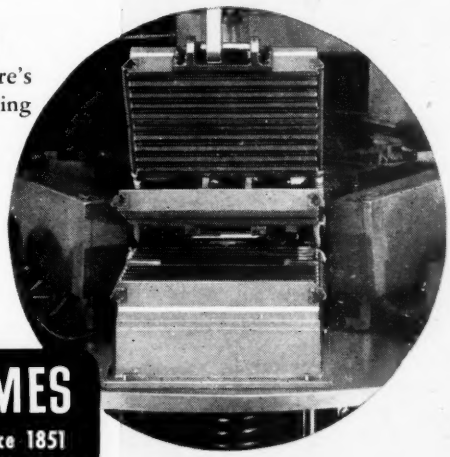
**SOLUTION:** Since the preliminary heating did not have to be done under pressure, Elmes hydraulic specialists visualized this operation as one stage of a *three-step sequence,* and they developed the revolving-table unit shown here. It's called a Three-Station Dial Feed Hot Molding Press. At one station the work is loaded and unloaded. At the next, preliminary heat is applied. And at the third, the work is subjected to pressure.

One *novel feature* is the mold design. To meet space limitations for the operator's convenience, Elmes engineers used a *three-leaf mold* that is hinged at the back to open like a book. And, as an *integral part* of the press, they provided an air hoist to open and close the molds, one leaf at a time.

Indexing is positive but gentle. A heavy spring lifts dial off bed while rotating. Each hot plate is individually controlled by a separate thermostat. One-man operated.

### GET THE PERFORMANCE YOU PAY FOR

You may never need a dial-feed press, but here's something to remember. *Whatever* your pressing problems, you can look to Elmes for the right answers—whether the press be standard production or a built-to-order "special." Elmes ingenuity *does things* with hydraulic pressure. The economies are well worth *your* investigation.



Mold as fully opened by the air hoist for unloading, cleaning, and reloading of bottom section. Half-travel of air hoist opens top section only. When hoist is in lowest position, upward movement of the press swings hoist hook clear for dial rotation. Downward movement of press automatically engages hook.

**ENGINEERED BY ELMES**

**Good Hydraulic Production Equipment Since 1851**

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 232 N. Morgan St., Chicago 7, Ill.

*Distributors in Principal Industrial Centers • Also Manufactured in Canada*

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Jim, have you heard about the naphtha put out recently by one of the big oil companies?
Yes, Tom, but I'm sticking to SKELLYSOLVE! When all's said and done, it's the "real McCoy!"

**"DOC" MacGEE SAYS:** There *must* be a reason for the wide and growing preference that purchasing agents, chemists, superintendents and managers have for SKELLYSOLVE. They *know* they can't go wrong by ordering SKELLYSOLVE for their operations. Why? Because SKELLYSOLVE'S unvarying high quality, dependability, purity, and economy are *proved!*

Skelly Oil Company *pioneered* the large scale production of the hexane, heptane, and octane type naphthas from natural gas . . . began back in 1930. A development that has provided special industrial naphthas with a quality exceeding anything ever known in the petroleum industry before.

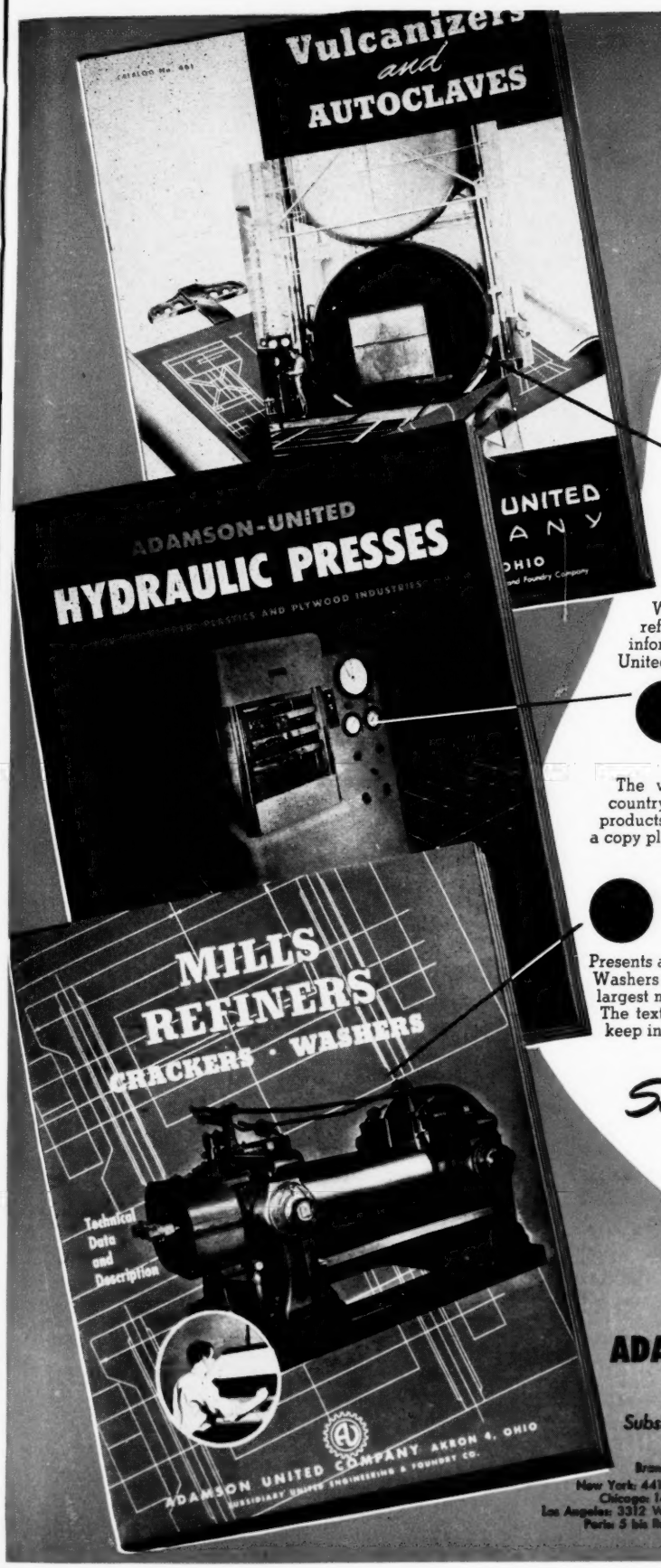
High-quality SKELLYSOLVE has enabled the rubber, oil and fat, ink and other industries to save money, improve operations, and produce better products. For proof of this, consider the fact that numerous plants have switched to SKELLYSOLVE from the competitive naphthas or solvents they were using—and that more plants are changing to SKELLYSOLVE every day.

Yes, SKELLYSOLVE is giving more satisfactory results in more and more industrial operations. Remember this when you hear of other naphthas claimed to be "just as good as" or even "better than" SKELLYSOLVE. Remember that, when all is said and done, SKELLYSOLVE is the "real McCoy"!

# Skellysolve

SKELLY

**SOLVENTS DIVISION, SKELLY OIL COMPANY, KANSAS CITY, MO.**




## We'd like to give you *these Three Booklets*

**Vulcanizers and Autoclaves**

Illustrates and describes the principal types of vulcanizers and autoclaves developed and manufactured by Adamson United and successfully used by leading rubber companies here and abroad. Whether for present information or as a source of future reference, this new catalog will prove valuable for the information it contains and as an outline of Adamson United vulcanizing equipment.

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The various types of presses successfully used by the country's largest manufacturers of rubber and plastics products are described and illustrated. A letter requesting a copy places you under no obligation.

**Mills, Refiners, Crackers, Washers**

Presents a wide range of modern Mills, Refiners, Crackers and Washers we have designed and built for some of the world's largest manufacturers and processers of rubber and plastics. The text is carefully compiled information you will want to keep in your files for reference.

*Send for them Today!*

ADAMSON UNITED COMPANY engineers will gladly cooperate with you on all your technical problems and supply all possible data and information. Our abilities, experience and extensive manufacturing facilities are at the service of the industry.

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# HERE'S NEWS!

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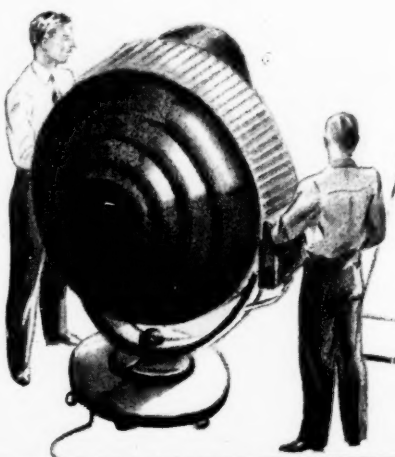
## AN *Exceptional* STABILIZER FOR PVC AND RESIN COPOLYMERS

1 IMPROVES PRODUCT QUALITY

2 EXTENDS AGING 2 TO 3 TIMES OVER ORDINARY STABILIZERS IN SUNLIGHT, ULTRA VIOLET AND HIGH TEMPERATURE TESTS . . .



HARWICK STANDARD CHEMICAL COMPANY

*Has been appointed Sole Sales Distributors by the*

STABELAN CHEMICAL COMPANY

Three remarkable types of stabilizers for PVC and Resin Copolymers have been produced under the name of STABELAN . . . Type A for ultra violet and sunlight aging; Type XL for high temperature in processing as well as ultra violet and sunlight aging; and Type G suggested wherever perfect clarity is required as well as for use with organic reds and for high temperature processing, ultra violet and sunlight aging . . . Write for comparative test data.

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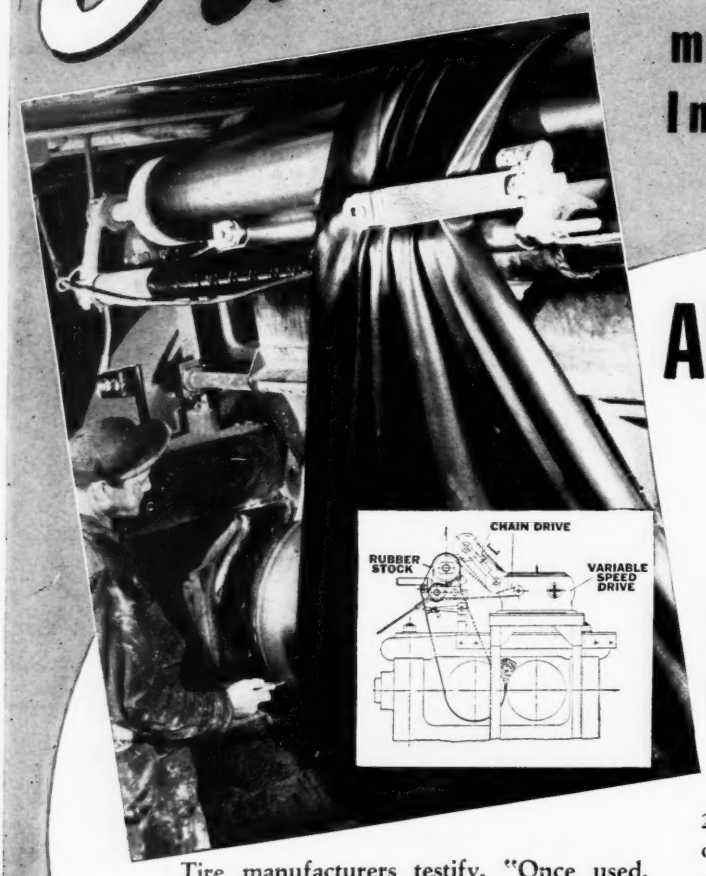
# 6 BIG ADVANTAGES..

## make this attachment Indispensable!

## ..the Akron-Standard STOCK BLENDER




Tire manufacturers testify, "Once used, never without." Handling labor is reduced. Operation is automatic until the milled stock is removed. Speed up your operation and enjoy more uniform stock production through these six features:

1. Manpower goes further. One workman can run two or more mills. No more laborious hand blending and warm-up.

2. Temperature reduced by passing compound or batch overhead. Cooler stocks permit adding accelerators without scorching.

3. Positive bank control with lower power consumption.

4. Correct milling time for every batch.

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6. Uniform operation, uniform plasticity, uniform dispersion.

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**1624 Englewood Avenue** *"The Established Measure of Value"* **Akron 5, Ohio, U. S. A.**

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## *in a Pint Can*

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They've often found the welcome answer to a troublesome requirement for coating, laminating, saturating, bonding or other fabrication problem.

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As a result, Flintkote Liquid Products find wide use in many branches of industry. Some are used for rug and carpet backing, others as paper and textile laminants and sizings, curled hair binders, or adhesives.

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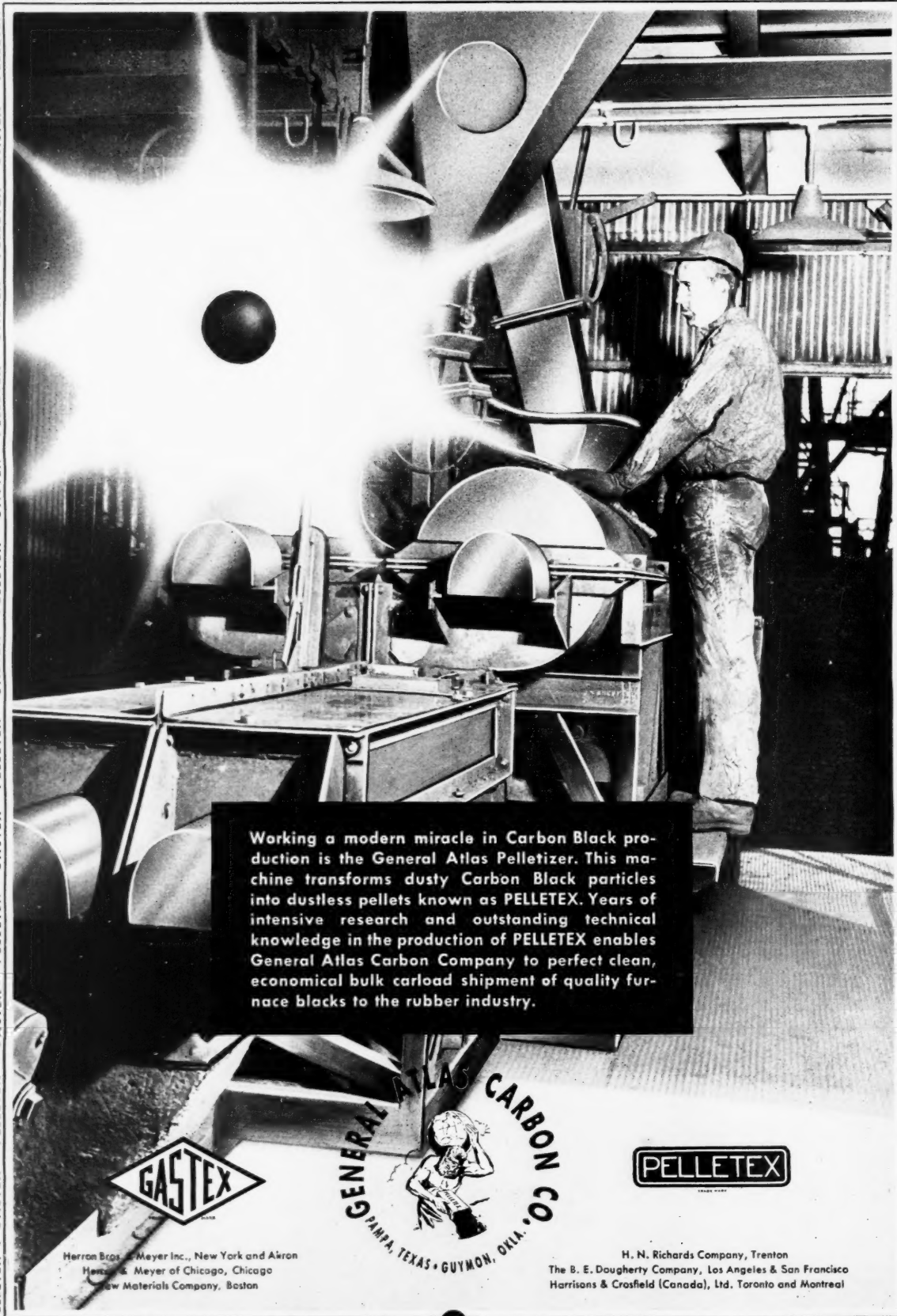

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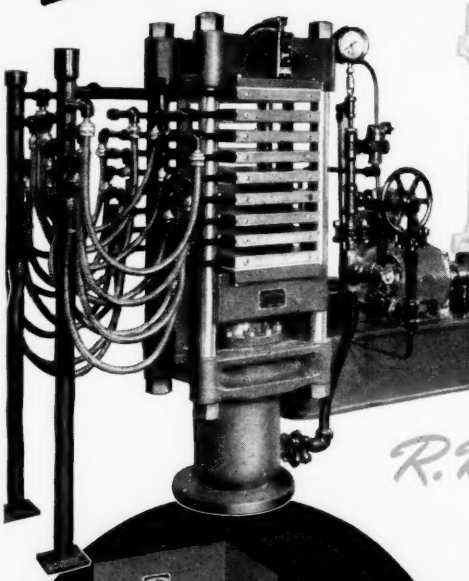
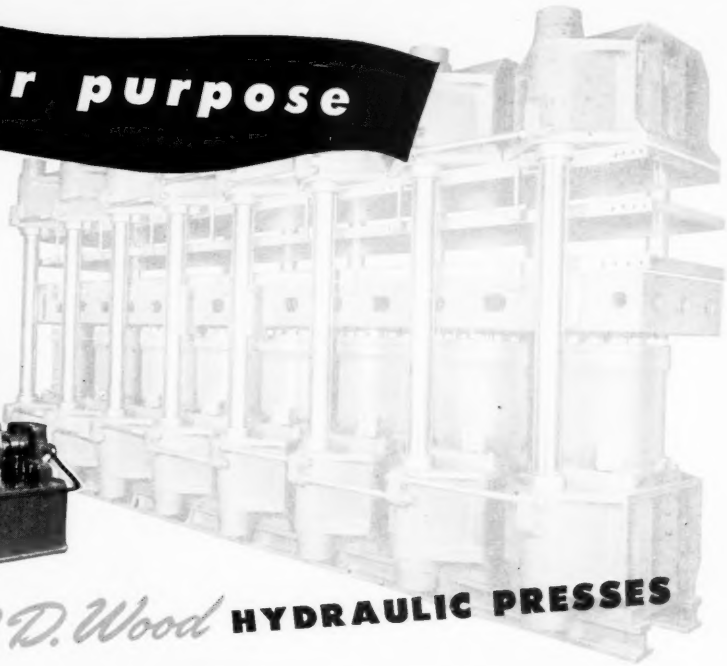
# to fit your purpose





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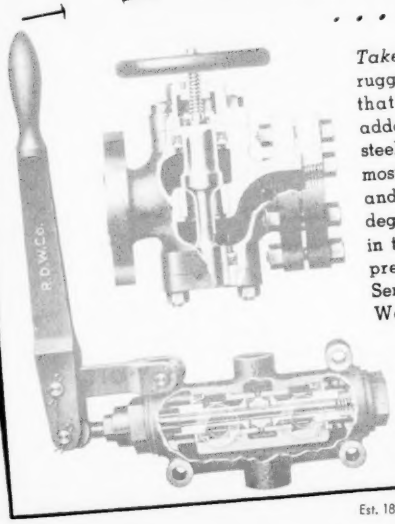




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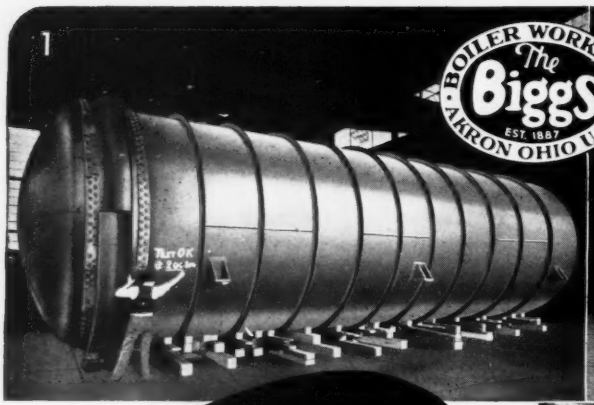
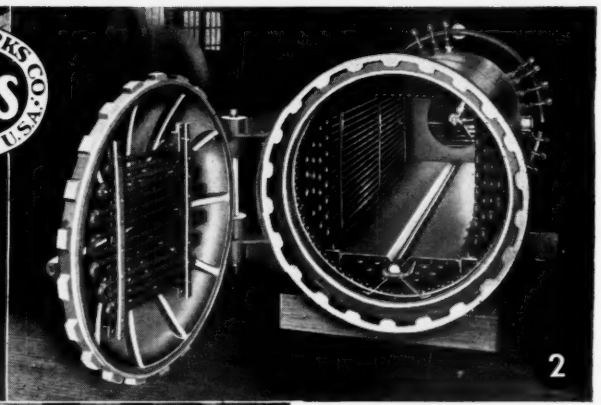



# Biggs

## VULCANIZERS and DEVULCANIZERS Have Served the Rubber Industry for More Than 45 Years

*Fig. 1*—15-ft. diameter by 45-ft. long horizontal vulcanizer with quick-opening door for vulcanizing rubber linings in large storage tanks. *Fig. 2*—Biggs vulcanizer with special heating manifolds and circulating fan; all sizes, various working pressures.

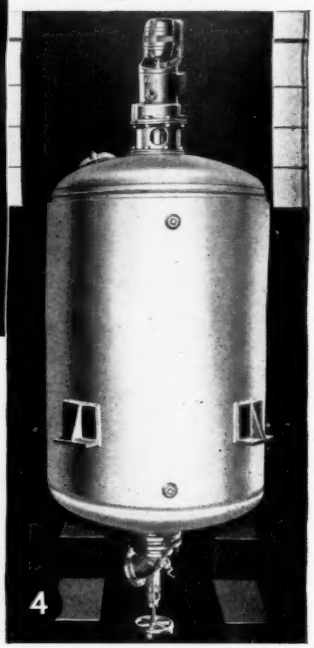
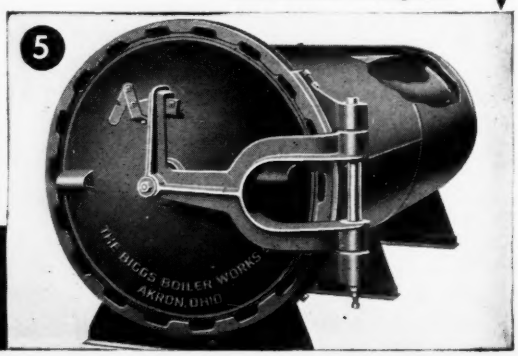



*Fig. 3*—vertical vulcanizer with quick-opening door. Door is handled by self-contained arm and gear-operating mechanism. Hand or motor operation.

*Fig. 4*—high pressure heavy duty jacketed vertical devulcanizer with special agitator. Furnished in various sizes.

*Fig. 5*—horizontal steam-jacketed vulcanizer with hinge type quick-opening door; all sizes, for various working pressures. Welded construction throughout.

BIGGS-built vulcanizers and devulcanizers have occupied a prominent place in the development of the rubber industry since its inception. For more than 45 years Biggs has furnished single-shell and jacketed vulcanizers both vertical and horizontal, as well as many different types of devulcanizers to meet various requirements of the reclaim experts. . . . It is a far cry from the old days of bolted doors and riveted construction to Biggs modern all-welded units with quick-opening doors. Biggs vulcanizers and devulcanizers are available in all sizes and for various working pressures — with numerous special features. *Write now for our Bulletin 45.*

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STRONGER THAN THE PLATE ITSELF
EST. 1887

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Chemicals for the Nation's Vital Industries

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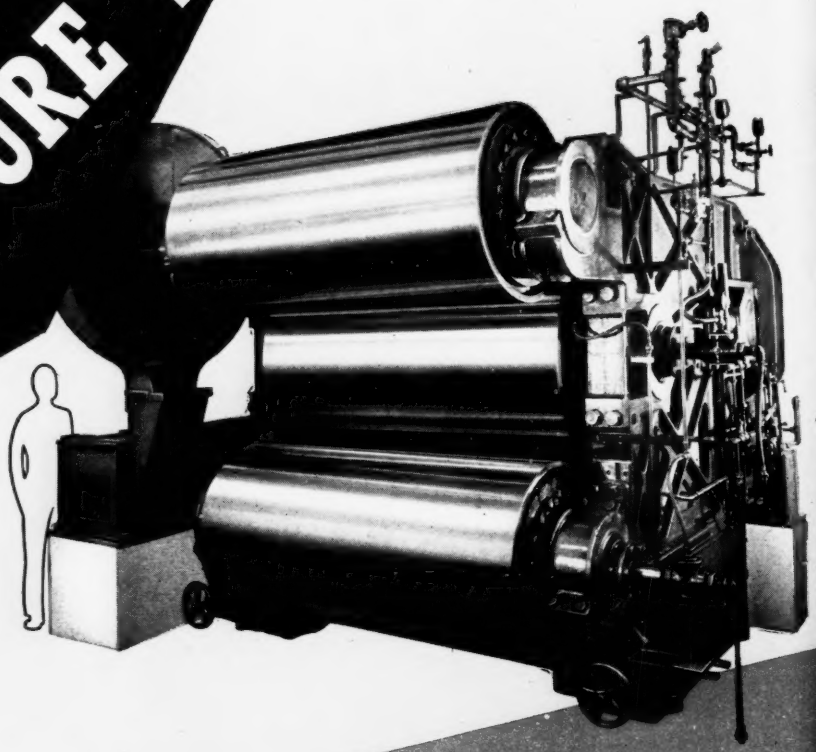
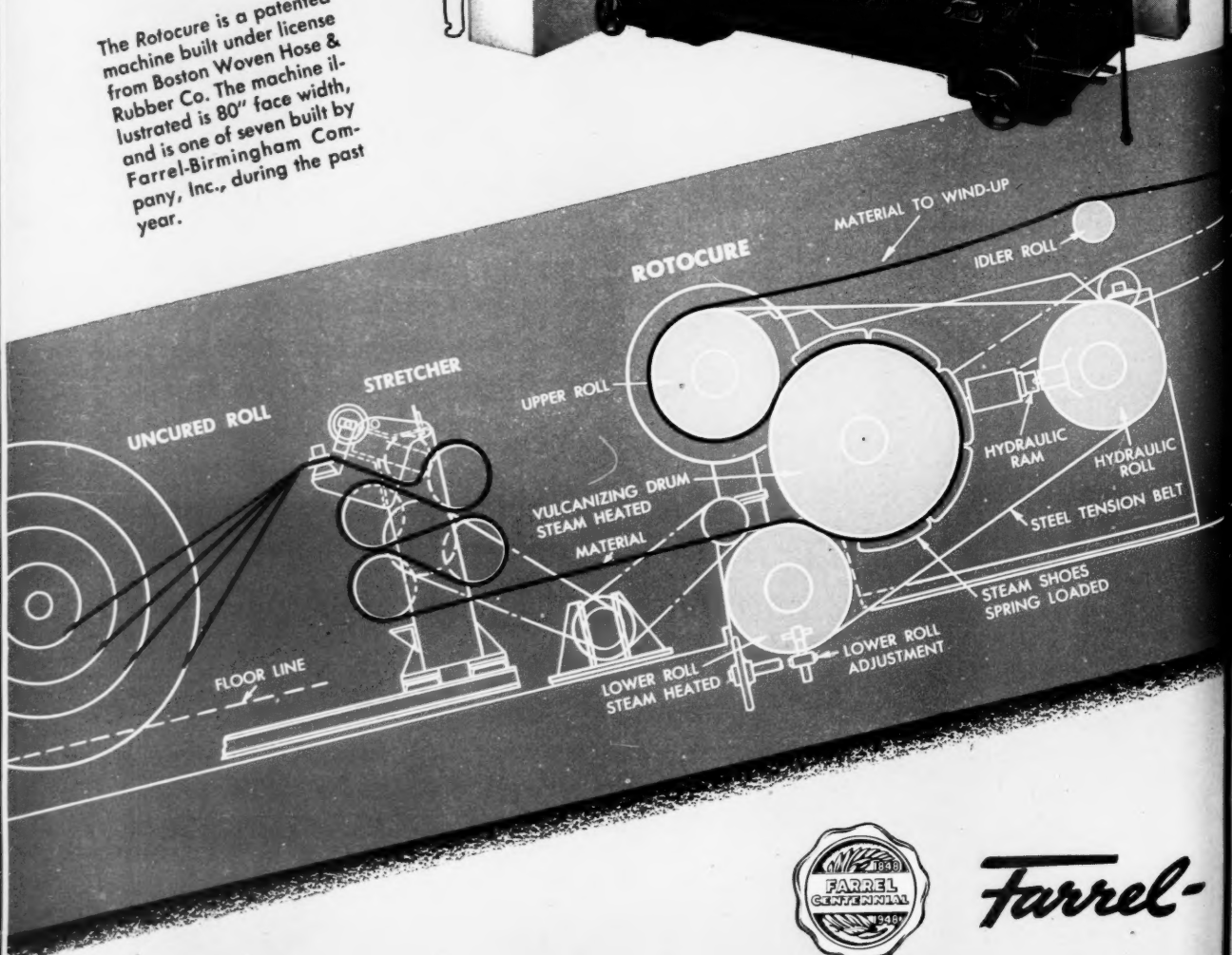
# THIS IS THE ROTOCURE®



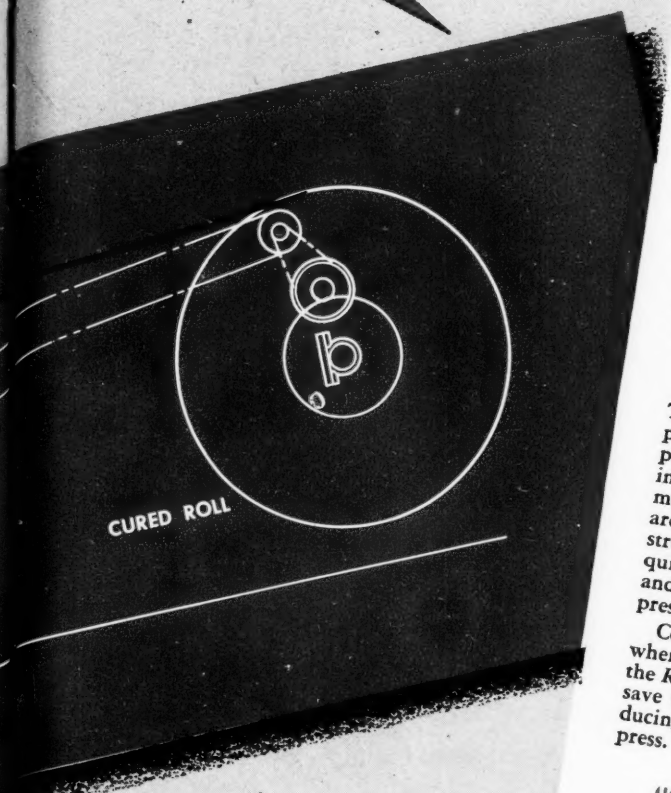
The Rotocure is a patented machine built under license from Boston Woven Hose & Rubber Co. The machine illustrated is 80" face width, and is one of seven built by Farrel-Birmingham Company, Inc., during the past year.




1848 FARREL CENTENNIAL 1948

Farrel-

# FOR CONTINUOUSLY VULCANIZING RUBBER AND PROCESSING PLASTICS




## HOW THE ROTOCURE WORKS

In operation, the rubber or plastic material is carried around an arc of the heated steel drum by a wide, high tensile, steel belt (see diagram). The belt, which is tensioned by a back roll actuated by hydraulic cylinders, maintains a pressure on the material of approximately 60 to 65 P.S.I. Located around the circumference of the drum, and bearing against the back of the steel belt, are five heating shoes.

The drum and shoes are heated internally by steam to give a material temperature of approximately 280° to 300° F for rubber and 300° to 340° F for plastics. For gauge control, the material is fed to the drum over the lower pressure roll which can exert pressure up to approximately 1000 pounds per linear inch.

The lower pressure roll is internally heated by steam to preheat the material and thus reduce the time of passage around the main drum. Where required for postheating, the top roll can also be steam-heated.

## PRODUCTS THE ROTOCURE CAN PRODUCE

Where the run of any one size or type of materials is great enough, the *Rotocure* has a number of advantages over vulcanizing presses for producing: Conveyor belting, transmission belting, floor matting (supported and unsupported), rubber flooring (sheet and tile), plastic flooring (sheet and tile) and plastic laminations. In addition, the machine has great possibilities for the production of many other rubber and plastic products.

## ADVANTAGES

The advantages of this machine over vulcanizing presses are: (1) Continuous operation increases production by eliminating interruptions for opening, unloading, loading and closing; (2) where material is cured in long lengths, double-cure around the overlap area, necking and non-uniform stretch are avoided; (3) less floor space is required, and (4) the work area can be kept cleaner and free from water which is common in belt press pits.

Comparison of production costs indicates that where manufacturing conditions favor the use of the *Rotocure*, this machine, on some products, can save up to nearly 50 per cent of the cost of producing an equivalent volume with a vulcanizing press.

## HOW YOU CAN LEARN MORE ABOUT THE ROTOCURE

We shall be glad to have a Farrel-Birmingham engineer discuss with you the possibilities of the machine for your particular conditions. The experience gained in building seven of these machines for different applications will be of value in determining what the machine can be expected to do for you. A request for an appointment (or for further details by mail) involves no obligation.

**FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.**
*Plants:* Ansonia and Derby, Conn., Buffalo, N.Y.
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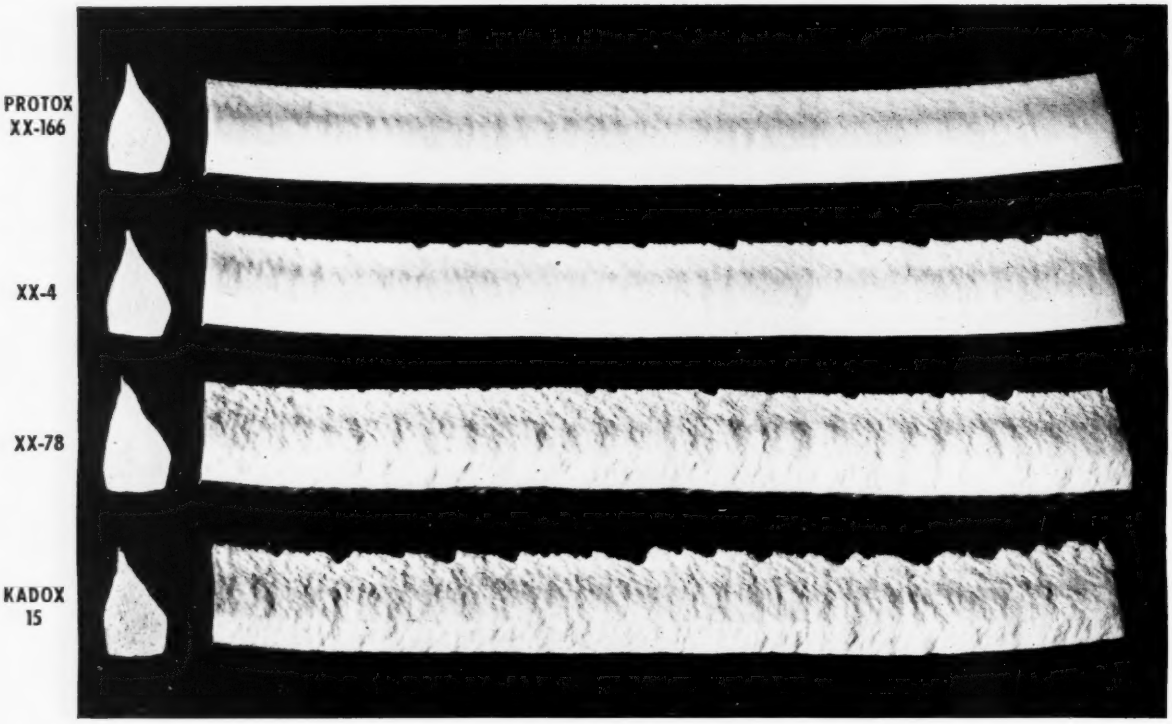
# PROTOX-166 ZINC OXIDE




ZINC OXIDE AND GR-S

## TUBING CHARACTERISTICS
## in the ½ Royle Laboratory Tuber Using the Garvey Die

EQUAL parts by weight of GR-S and Zinc Oxide of different grades, representing a range in particle size and type, were compounded and mixed under the same conditions, and allowed to stand overnight. The following day the stocks were warmed up, and tubed in the Royle tuber with the screw operating at 50 R.P.M. The cylinder temperature was 40 C., the extension temperature 62 C., and the head temperature 105 C. The processing advantages of Protox-166 are shown in the accompanying unretouched photograph.

Similar results obtained in natural rubber will be reported later.

HORSE HEAD PRODUCTS

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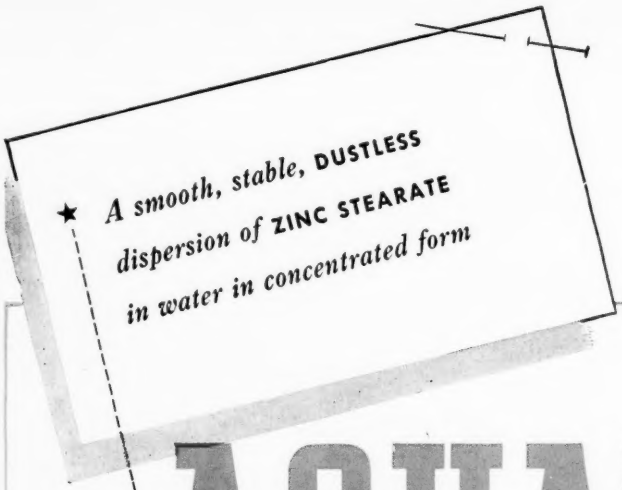


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AQUAZINC is particularly convenient for surface application of Zinc Stearate. When diluted with 8 to 20 parts of water, it can be applied by spray or bath.

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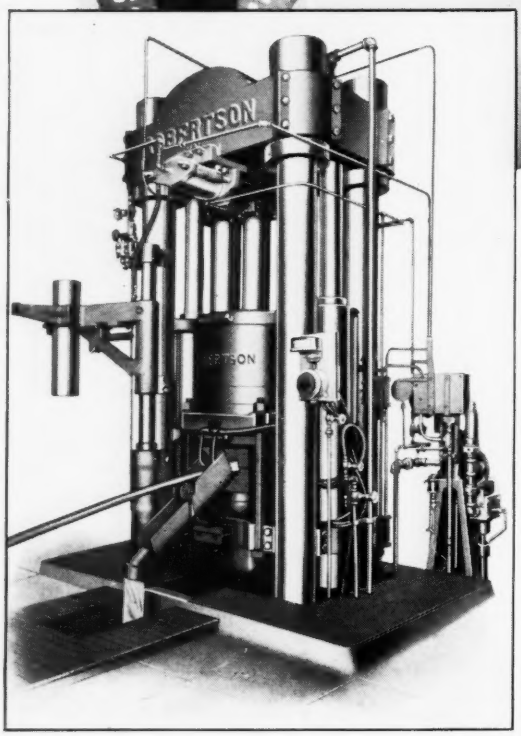
# This HOSE LEAD ENCASING PRESS

by Robertson



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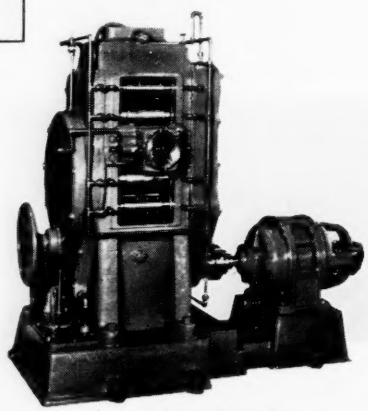
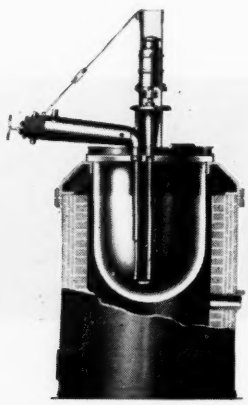
More than 89 years' specialized experience in the design and manufacture of high pressure hydraulic equipment is at your service. Ask us to help you solve your lead encasing problems.

We also design and build Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Lead Sheath Stripping Machines and Hydraulic Equipment for Special Uses. Write for details.



Lead Sheath Stripping Machine



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These versatile pigments are opening new fields in plastic color possibilities because of their outstanding properties. They provide extreme brilliance . . . great stability . . . chemical inertness . . . resistance to fading . . . freedom from bleeding.

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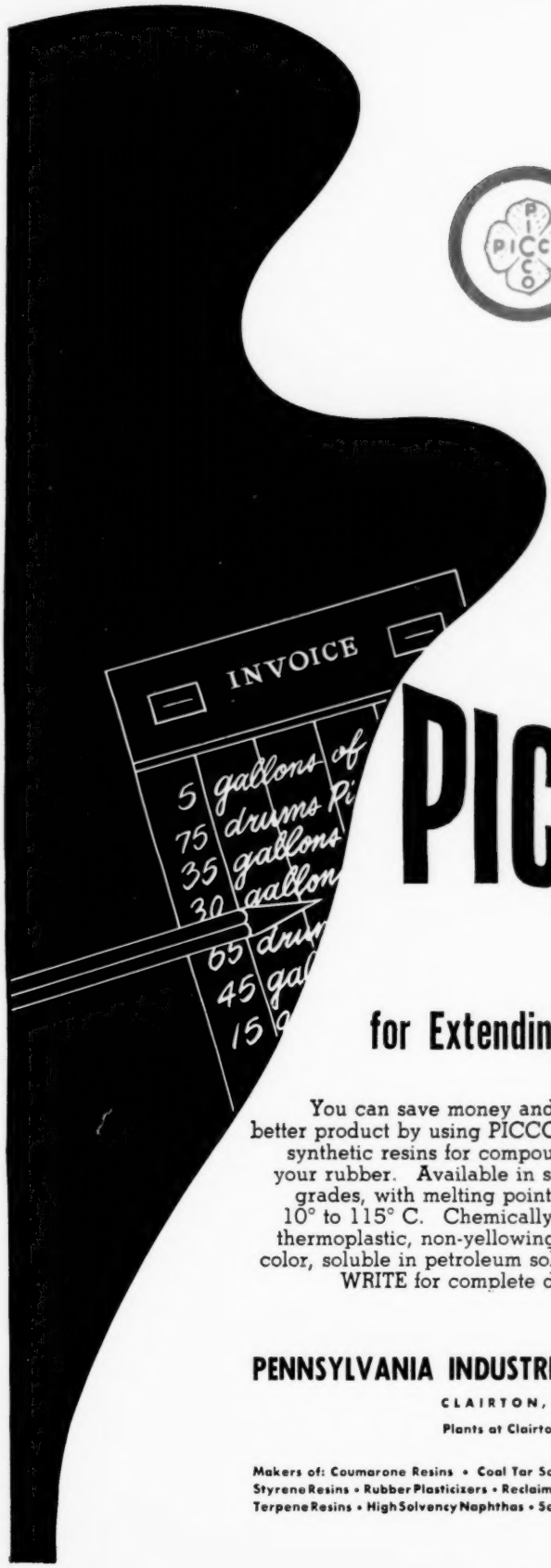


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*the versatile resin*

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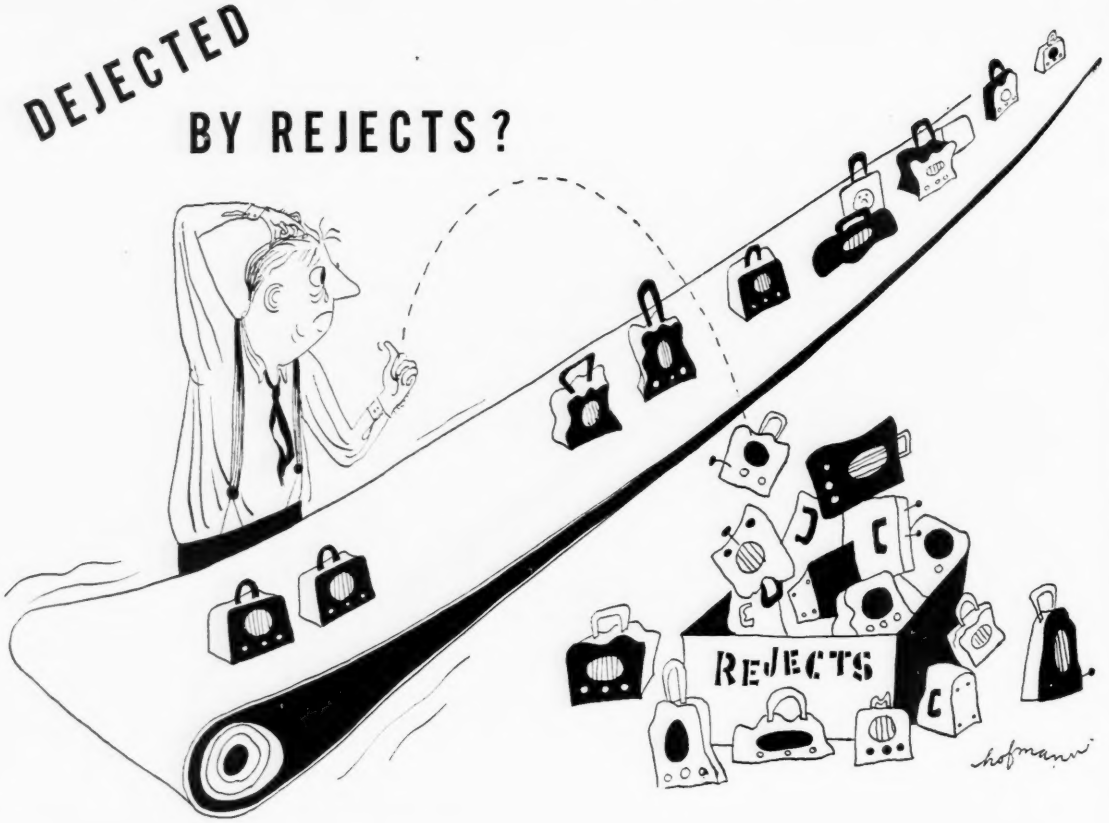


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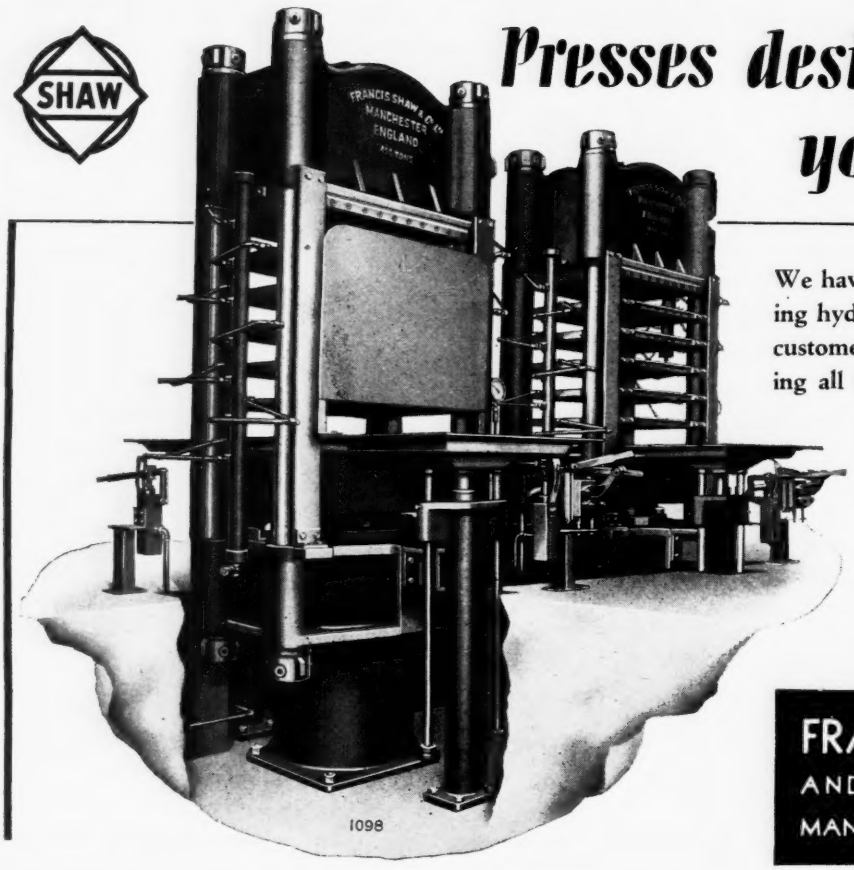


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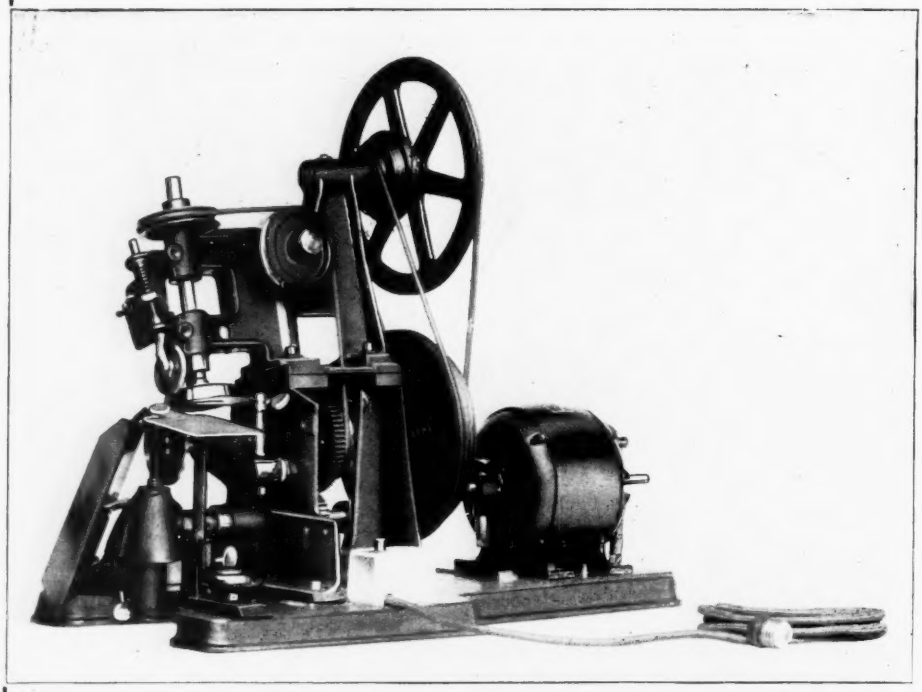

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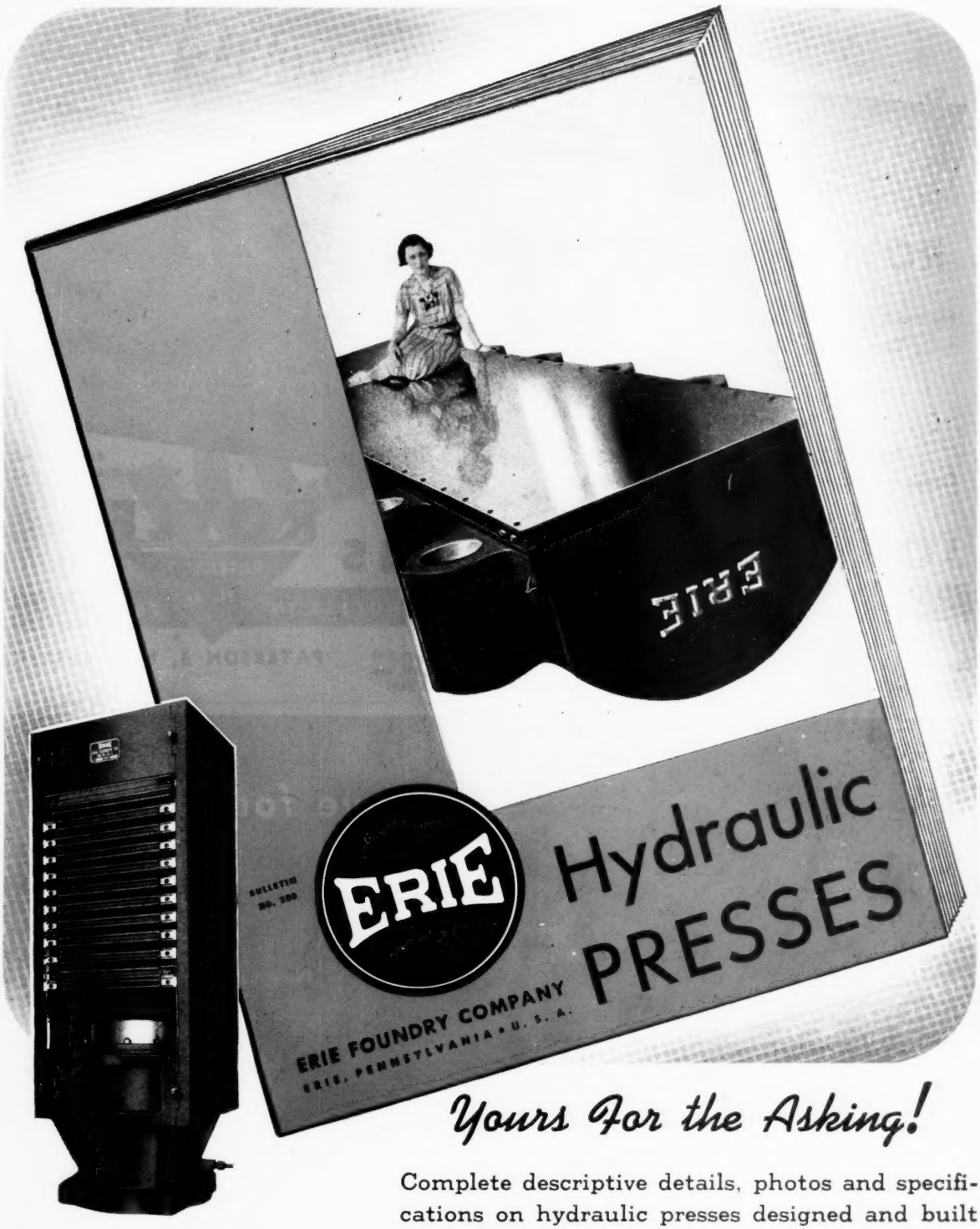


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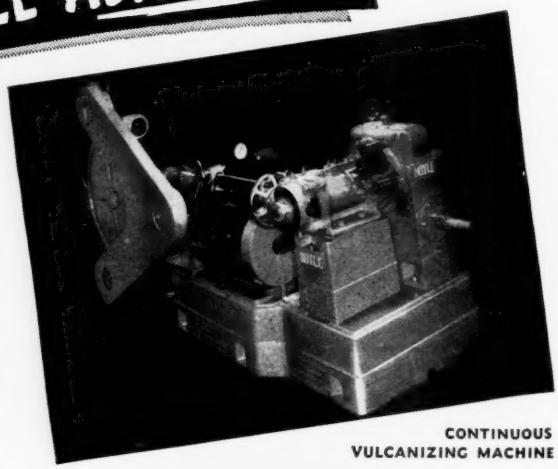

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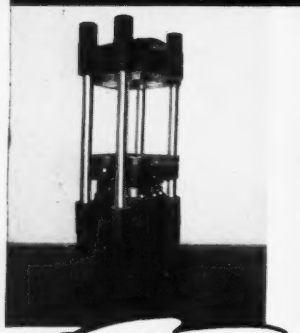

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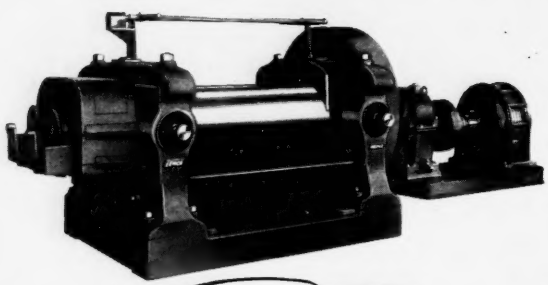

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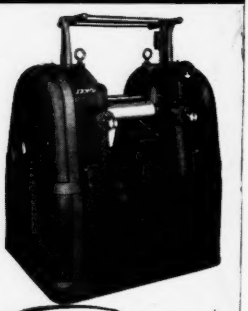

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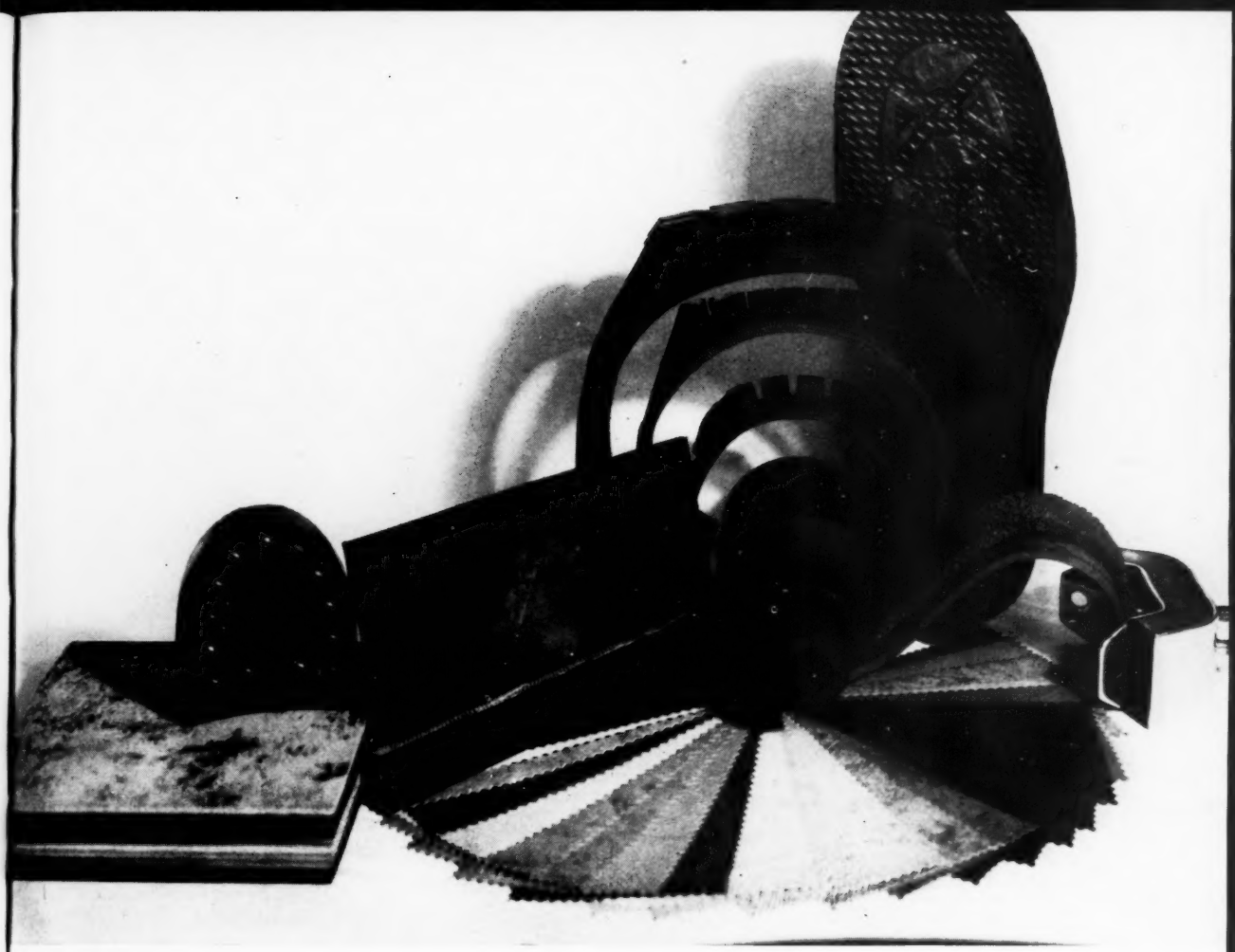

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Volume 118 | New York, July, 1948 | Number 4

# The Formation and Structure of Vulcanizates[1]

J. Bardwell[2] and C. A. Winkler[3]

THE characteristic mechanical properties of vulcanized rubber are believed to result from a network structure made up of chainlike molecules bonded together by occasional cross-linkages. In relating the physical properties of the vulcanizate to the structure of the network, it is therefore necessary to consider the concentration of cross-linkages and the molecular weight distribution of the rubber molecules prior to cross-linking. Various theories have been proposed for the dependence of elastic properties on these structural factors, but experimental proof of the suggested relations has been meager, largely because of the complexities met with in vulcanization reactions. In the present investigation some of these difficulties have been overcome, and the quantitative relations between the elastic behavior of GR-S and its network structure have thereby been revealed.

## Theoretical Considerations

### Elasticity

Of the many theories that have been proposed to account for rubber-like elasticity the most explicit are those which consider the configurations of coiling molecules. The "equation of state" for systems of flexible chains has been expressed (1-5)[4] in the form:

$$\tau = \frac{\nu}{V} RT \left\{ \frac{1}{l_o} - \frac{l_o^2}{l^2} \right\} \qquad \ldots . (1)$$

$\tau$ = tension (force per unit area of initial cross-section).
R = gas constant.
T = absolute temperature.
$l$ = stretched length.
$l_o$ = unstretched length.
$\frac{\nu}{V}$ is a proportionality constant representing the rigidity of the particular rubber sample and dependent on structure. Several authors (1, 3, 4) have interpreted $\nu$ as the number of "chains" in volume V, but here $\frac{\nu}{V}$ will be regarded as an *experimental* quantity and will henceforth be called the "network activity."

The dependence of tension on temperature and elongation expressed by Equation 1 agrees fairly well with experimental thermoelastic properties (6, 7, 8) and stress-strain curves (6, 8-10) for various rubber-like polymers. It is with the dependence of the remaining term, $\frac{\nu}{V}$, on net work structure that we are here chiefly concerned. In several elasticity theories this quantity is proportional to the number of "chains" per unit volume, where the "chain" is defined as the part of a molecule extending from one cross-linkage to the next. For an ideal network formed from indefinitely long molecules the number of "chains" is identical with the number of cross-linked monomer units or equal to twice the number of cross-linkages. If a fraction $\rho$ of the structural units is involved in cross-linkages, the concentration of chains (moles per c.c.) is $\frac{d}{M_o}\rho$, and the theoretical relation between network activity and degree of cross-linking, $\rho$, is given by:

$$\frac{\nu}{V} = g \frac{d}{M_o} \rho \qquad \ldots . (2)$$

d = density of polymer (gm/c.c.)
$M_o$ = molecular weight of the structural unit.

The proportionality "constant," g, is unity in the theories developed by Wall (1, 11), Treloar (3), and Flory and Rehner (4). It has the value 7/3 in the theory of Kuhn (5, 12) and about ½ in that of James and Guth (13).

Flory has taken into account the molecular weight of the polymer before cross-linking (9, 14). Each "primary molecule" is considered to give rise to two inactive terminal chains in the vulcanizate, thereby leading to an "effective" degree of cross-linking of $\rho \frac{2}{y_n}$, where $y_n$ is the number average degree of polymerization prior to cross-linking. Equation 2 may then be modified to

[1] Presented before Rubber Division, Chemical Institute of Canada, Montreal, P. Q., Canada, June 9, 1948.
[2] Work done while at McGill University, Montreal. Present address, National Research Council, Ottawa, Ont., Canada.
[3] Professor of Chemistry, McGill University.
[4] Numbers in parentheses refer to bibliography references at end of article.

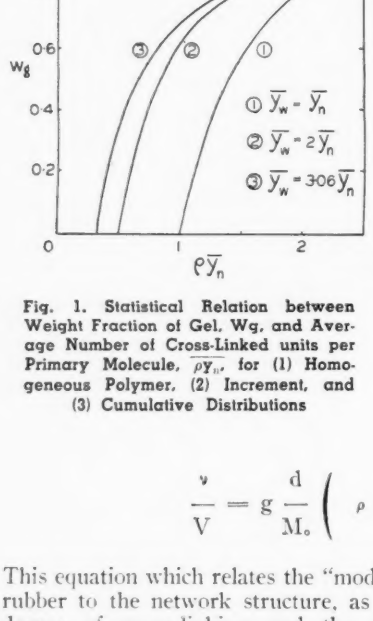



**Fig. 1. Statistical Relation between Weight Fraction of Gel, Wg, and Average Number of Cross-Linked units per Primary Molecule, $\rho\overline{y_n}$, for (1) Homogeneous Polymer, (2) Increment, and (3) Cumulative Distributions**

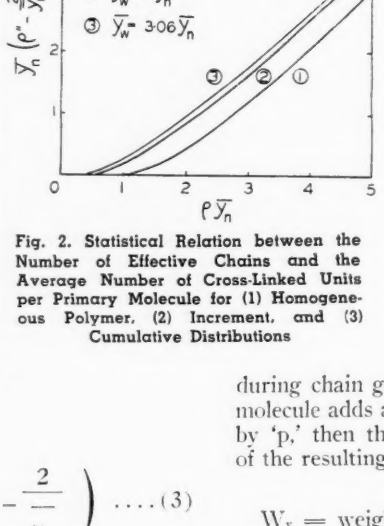



**Fig. 2. Statistical Relation between the Number of Effective Chains and the Average Number of Cross-Linked Units per Primary Molecule for (1) Homogeneous Polymer, (2) Increment, and (3) Cumulative Distributions**

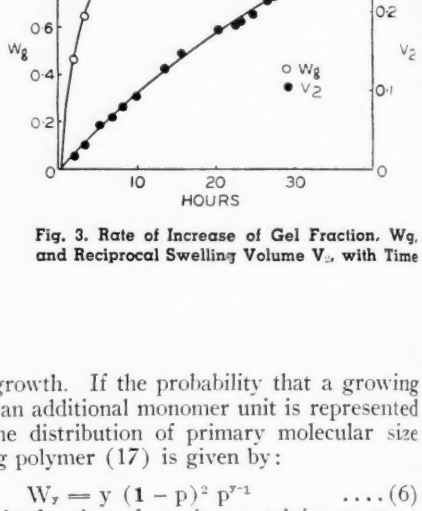



**Fig. 3. Rate of Increase of Gel Fraction, Wg, and Reciprocal Swelling Volume $V_2$, with Time**

$$\frac{\nu}{V} = g\,\frac{d}{M_o}\left(\rho - \frac{2}{\overline{y_n}}\right) \quad \ldots.(3)$$

This equation which relates the "modulus" of vulcanized rubber to the network structure, as determined by the degree of cross-linking and the primary molecular weight, has hitherto received only partial experimental verification. Experiments by Flory with close-cut fractions of Butyl rubber confirmed the validity of the correction for initial molecular weight, but failed to support the theoretical proportionality between network activity and degree of cross-linking (9, 14). Experimental values of g were 3.3 for $\rho = 1.6 \times 10^{-3}$ and 2.1 for $\rho = 2.8 \times 10^{-3}$. Flory has suggested that the discrepancy between theory and experiment results from the presence of entanglements within the network.

## Swelling

Although the "network activity" is generally estimated from modulus measurements, it may also be determined from observation of the equilibrium swelling volume (15). The relation is given by:

$$\frac{\nu}{V} = \frac{\ln(1 - v_2) + v_2 + \mu_g v_2^2}{-V_1 v_2^{1/3}} \quad \ldots.(4)$$

$v_2$ = volume fraction of polymer in the swollen gel in equilibrium with pure solvent, i.e., the reciprocal of the "swelling volume" (ratio of the volumes of swollen and dried gel).

$\mu_g$ = solvent-polymer interaction coefficient (16).

$V_1$ = molar volume of solvent.

For large swelling ($v_2$ small) Equation 4 reduces to the approximate expression:

$$\frac{\nu}{V} = \frac{(1 - 2\mu_g)\, v_2^{5/3}}{2 V_1} \quad \ldots.(5)$$

## Primary Molecular Weight Distribution

The primary molecule is defined as the polymeric molecule that exists prior to cross-linking and therefore constitutes a basic factor in vulcanizate structure. The size distribution of the primary molecules is the statistical result of the random occurrence of termination steps during chain growth. If the probability that a growing molecule adds an additional monomer unit is represented by 'p,' then the distribution of primary molecular size of the resulting polymer (17) is given by:

$$W_y = y\,(1 - p)^2\, p^{y-1} \quad \ldots.(6)$$

$W_y$ = weight fraction of species containing y structural units.

For this distribution the "weight average" degree of polymerization, $\overline{y_w}$, is twice the "number average," $\overline{y_n}$; i.e., the heterogeneity index is two (17).

With polymers formed in the presence of a chain transfer agent (modifier) the number average degree of polymerization of the primary molecules may be obtained from measurements of modifier consumption, viz.

$$\overline{y_n} = \frac{\alpha}{R_o\,(1 - \varepsilon^{-r\alpha})} \quad \ldots.(7)$$

$\alpha$ = fractional conversion.

$R_o$ = modifier concentration (as moles per mole of initial monomer).

r = "regulating index" (18).

Depletion of modifier during polymerization broadens the primary molecular weight distribution somewhat; the primary heterogeneity index at conversion $\alpha$ is given by (19):

$$\frac{\overline{y_w}}{\overline{y_n}} = \frac{2}{(r\alpha)^2}\,(\varepsilon^{r\alpha} - 1)\,(1 - \varepsilon^{-r\alpha}) \quad \ldots.(8)$$

## Network Formation

During vulcanization, the long chains of a rubber-like polymer are bonded together at randomly selected points, and larger and larger structures are thereby built up. As the process of interlinking continues, a point is reached where "infinite networks" pervading the entire volume suddenly appear (20). Such networks are insoluble and constitute the familiar gel fraction. Further cross-linking results in increasing amounts of gel and in cyclic connections within the gel structure.

On the assumption that cross-linking is random and that intramolecular connections within the sol fraction may be neglected, Flory (20-21) and Stockmayer (22) have developed a statistical treatment of the cross-linking process. Figure 1 shows the theoretical course of gelation as a function of the average number of cross-linked units per primary molecule ($\rho\,\overline{y_n}$) for three cases,

viz., the homogeneous polymer, the "increment" distribution (Equation 6), and the cumulative distribution resulting from 90% depletion of modifier (19). The latter corresponds to a heterogeneity index of 3.06.

As cross-linking proceeds beyond the gel point, cyclic connections form within the gel structure. Only these connections give rise to "effective" chains. The number of such effective chains per primary molecule is given by $\frac{2}{\overline{y_n}}(\rho'' - \overline{y_n''})$ where $\rho''$ and $\overline{y_n''}$ are the values of $\rho$ and $y_n$ in the gel. Figure 2 shows the theoretical number of effective chains per primary molecule for the same three distributions. The curves shown in Figures 1 and 2 were calculated by the method proposed by Flory (21).

## Experimental Details

### Preparation of Polymers

The copolymer of butadiene and styrene (GR-S) was prepared by the well-known bottle polymerization method (18, 23). After addition of shortstop to the latex, unreacted monomer was removed by vacuum distillation at about 40° C. The molecular weight of the polymer was varied by manipulation of the amount of modifier used (Sharples tertiary dodecyl mercaptan). The "regulating index" of this modifier is 3.16 (18). The degree of polymerization of the primary molecules was calculated by means of Equation 7; due allowance was made for compositional changes during polymerization (24). The heterogeneity index was calculated by means of Equation 8 and is shown in Table 1 together with other relevant characteristics of the polymers.

Table 1. Degree of Polymerization and Heterogeneity Index of Modified GR-S Polymers

| Polymer No. | Mercaptan Charged (Moles per Mole of Initial Monomer) $R_0$ | Conversion $\alpha$ | Number Average Degree of Polymerization $y_n$ | Heterogeneity Index $\frac{y_w}{y_n}$ |
|---|---|---|---|---|
| I | 0.44 | 0.304 | 11600 | 2.16 |
| II | 1.42 | 0.232 | 3150 | 2.09 |
| III | 2.95 | 0.465 | 2080 | 2.38 |
| IV | 4.47 | 0.107 | 870 | 2.02 |
| V | 4.47 | 0.275 | 1100 | 2.13 |
| VI | 4.47 | 0.356 | 1220 | 2.22 |
| VII | 7.37 | 0.171 | 575 | 2.05 |
| VIII | 14.2 | 0.136 | 275 | 2.03 |
| IX | 58.9 | 0.515 | 110 | 2.52 |

### Cross-Linking Reaction

A buffered solution of potassium persulfate was added to the latex; the final mixture has the composition:

| | |
|---|---|
| Polymer (GR-S) | 5.0% |
| Potassium persulfate | 2.5% |
| Buffer (sodium carbonate-sodium bicarbonate) | 1.5% |

After thorough mixing, aliquots amounting to 25 c.c. were transferred to one-ounce bottles. Nitrogen was bubbled through the reaction mixture for 30 seconds, after which the bottle was capped tightly and immersed into a water bath at 50.0 ± 0.5° C. After suitable intervals the reaction was stopped by coagulating the polymer in rapidly stirring butanol containing 0.05% phenyl beta-naphthylamine antioxidant (P.B.N.A.). The coagulum was washed with butanol; 2% P.B.N.A. was added, and the polymer was dried for 12 hours at 80° C. in a vacuum oven.

To compare the cross-linking reaction brought about by potassium persulfate with more conventional vulcanizations, one of the polymers was mixed with compounding ingredients and cured at 140° C. The curing ingredients were added in the form of a colloidal dispersion to the latex, which was then coagulated in butanol. The coagulum was protected with P.B.N.A. and milled for a short time at room temperature; the roll separation was one millimeter. Portions of the coagulum were then cured at 140° C.

### Solubility and Swelling

Weighed fragments of the dried polymer were placed into small screen cages and extracted for 48 hours in toluene containing 0.05% P.B.N.A. The swollen gel was allowed to drain for five minutes in a small closed container, weighed, and then dried to constant weight. The gel fraction and swelling volume were calculated, using the values of 0.93 and 0.86 for the densities of GR-S and toluene, respectively. The solubility was corrected for the small amount of non-polymer components extractable in ethanol-toluene azeotrope containing 10% water (25).

## Results and Discussion

### Cross-Linking

The addition of potassium persulfate to GR-S latex results in progressive insolubilization of the polymer (Figure 3). The course of gelation is seen to resemble closely the theoretical curve (Figure 1) for the increase of gel fraction as cross-linkages are added. One may therefore employ the theoretical relation with confidence to deduce the degree of cross-linking from the measured gel fraction.

### The Relation of Swelling to Modulus

On comparing Equations 1 and 5 it is seen that the modulus of a vulcanizate is predicted to be approximately inversely proportional to the 5/3 power of the swelling volume. Measurements on GR-S pure gum vulcanizates amply confirm this relation (Figure 4).

Stress-strain curves were determined with a standard testing machine; the rate of extension was 20 inches a minute. In addition to the "dynamic" modulus determined in this way the "static" modulus was also estimated by subtracting the stress relaxation occurring during a period of 24 hours.

Figure 4 consists of a log-log plot of the dynamic and static moduli at 300% elongation ($\tau_{300}$) *vs.* the swelling volume in toluene (S.V.) Although both dynamic and static moduli show good correlation with the swelling volume, better agreement with theory is found for the static modulus. This result is not surprising since swelling volume represents an equilibrium type of deformation. The equation of the line in Figure 4 for the static modulus is:

$$\log \tau_{300} = 3.67 - 1.67 \log \text{S. V.}$$

The theoretical slope of (−5/3) is seen to be confirmed. By comparing the above equation with Equations 1 and 4, the value of $\mu_g$ is found to be 0.18 for GR-S in toluene. Small variations of styrene content do not appear to alter this value significantly.

### Swelling and Network Structure

It is evident from Figure 3 that large changes of swelling volume occur when the degree of cross-linking is altered. Marked dependence of swelling on primary molecular weight was also found when the various poly-

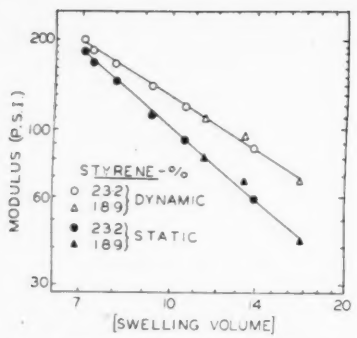



**Fig. 4. Modulus at 300% Elongation *vs.* Swelling Volume (Log-Log Plot)**

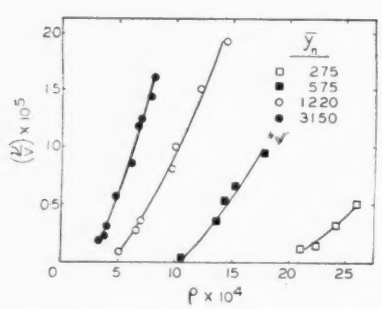



**Fig. 5. Network Activity *vs.* Degree of Cross-Linking**

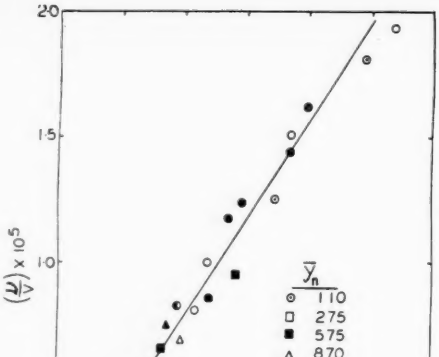



**Fig. 6. Network Activity *vs.* Effective Degree of Cross-Linking**

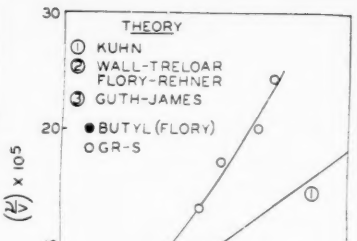



**Fig. 7. Network Activity *vs.* Effective Degree of Cross-Linking. Comparison of Experimental Results for GR-S and for Butyl (Flory) with Elasticity Theories**

mers listed in Table 1 were cross-linked by the same method. The dependence of swelling on network structure is best discussed in terms of the theoretical predictions summarized in Equation 3. For this purpose the value of $\rho$, the degree of cross-linking was calculated from the measured gel fraction with the assistance of Figure 1. The network activity $\frac{\nu}{V}$ was calculated from the observed swelling volume by means of Equation 4, using the value 0.18 for $\mu_E$.

Figure 5 shows the effect of both primary molecular weight and degree of cross-linking on the "network activity" (modulus) of GR-S. The effect of primary molecular weight is particularly noteworthy. Polymers of low primary molecular weight are handicapped in the development of reversible elasticity since relatively large concentrations of cross-linkages are required for the formation of a network. Even after the "gel point" is reached the increase of "modulus" is less rapid than with polymers of high primary molecular weight.

It is of interest to test the extent to which the results shown in Figure 5 agree with Flory's postulate that terminal chains are inactive during deformation. Accordingly, the effective degree of cross-linking $\rho'' - \frac{2}{\bar{y}_n''}$ for the various cross-linked polymers was deduced with the assistance of Figure 2. Consideration of the molecular weight in this way is seen to bring all the results into agreement (Figure 6). Thus the effect of molecular weight over a hundred-fold range is in quantitative agreement with the "network flaw" theory of vulcanizate structure (9).

The linearity of the resulting plot also verifies the proportionality between "network activity" and (effective) degree of cross-linking predicated by various elasticity theories. The equation of the line in Figure 6 is:

$$\frac{\nu}{V} = 0.039\left(\rho'' - \frac{2}{\bar{y}_n''}\right)$$

Substituting d = 0.93
$M_o$ = 59.2

and comparing with Equation 3, the value of g is found to be 2.5, in good agreement with the value of 7/3 predicted by Kuhn.

Figure 6 also includes the results deduced from the swelling and solubility of GR-S pure gum vulcanizates at low degrees of cure. The coincidence of the results demonstrates that the above conclusions concerning the effects of network structure are equally applicable to GR-S vulcanizates.

The effect of much higher concentrations of cross-linkages on the network activity was investigated by extending the reaction period with one of the polymers (III). The degree of cross-linking was calculated from the measured *rate* of insolubilization early in the reaction; due allowance was made for decomposition of persulfate ion. The results, shown in Figure 7, indicate that in this region the rigidity increases more rapidly than the effective degree of cross-linking. Included in Figure 7 are Flory's results for Butyl rubber (g = 3.3 and 2.1) and the predictions of elasticity theories. Of the various theories, that of Kuhn appears to be in closest agreement with the experimental results for GR-S except at high degrees of cure. Kuhn's hypothesis (5) that restraints in addition to chemical cross-linkages exist along the chains appears to be correct.

The most significant feature of these results is the way in which molecular weight exerts its effect on elastic properties. The ends of each primary molecule give rise to "flaws" in the network structure which are detrimental to physical properties (14, 26). Consideration of the relatively low value of the primary molecular weight of GR-S, as now produced, leads to the conclusion that such flaws make up a considerable fraction of the structure of typical vulcanizates.

The effect of *distribution* of primary molecular weight may be discussed on the basis of Figure 2. For a given number average primary molecular weight a fixed degree of cross-linking results in a slightly greater fraction of effective chains with the more *heterogeneous* polymer. This advantage of heterogeneity is small and may easily be illusory when processing difficulties are considered.

(*Continued on page 520*)

# Strain Tester for Rubber [1]

W. L. Holt[2], E. O. Knox[2], and F. L. Roth[2]

THE strain tester described herein was designed to measure the strain at a definite time after the application of a predetermined stress. In the usual testing procedure stress is measured at a specified strain during the extension of the specimen at a relatively rapid rate. Interest in the development of the strain tester resulted from investigations by one of us[3] which showed that replicate measurements of strain at a predetermined stress have a variance of approximately one-tenth the variance of the usual measurements of stress at a specified strain.

The apparatus was designed to permit routine measurements of strain at any selected stress below rupture to be made with the degree of precision found by Roth in the earlier investigation. In designing the strain tester, accuracy of measurement, as well as precision, was considered. The design features which are responsible for the improved precision and accuracy of measurements in the strain test are: (1) observation of bench marks when they are essentially at rest, (2) use of freely suspended weights to attain the desired stresses without friction effects, and (3) increase in distance between bench marks of from two to four times that possible with usual dumbbell-shaped specimens.

This test is not intended to measure stress-strain properties near or at rupture. For control testing, however, and for many research tests a knowledge of the properties below the region of failure is sufficient. The improved precision of the strain test warrants a separate determination of the properties at failure in those cases where they are necessary.

## Details of Construction

Three accessory instruments are required to prepare specimens for measurements in the strain tester. These are (1) a die to cut specimens from a sheet of rubber, (2) a device for placing bench marks on the specimen, and (3) a device for determining the average thickness of the specimen. The construction of each of these instruments and of the strain tester is described in turn.

[1] The tester was designed and constructed at the request of the Subcommittee on Test Methods of the Committee on Specifications for Synthetic Rubbers and was financed in part by funds transferred from the Office of Rubber Reserve, Reconstruction Finance Corp.

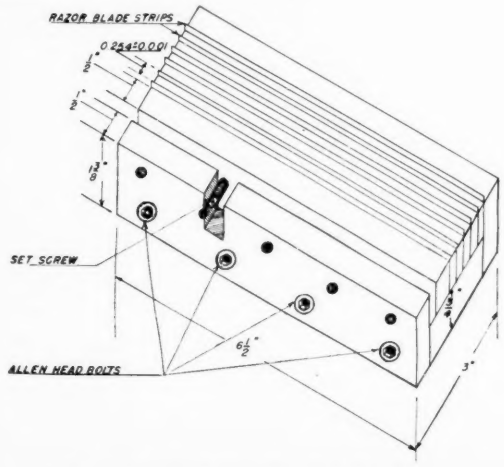



Fig. 1. Die for Cutting Five Test Specimens

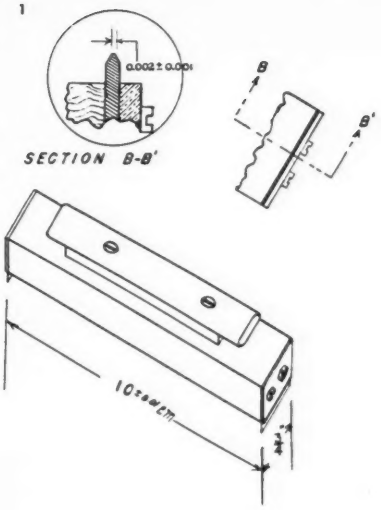



Fig. 2. Bench Marker

### Die for Cutting Specimen

The construction of the die used to cut specimens from a sheet of rubber is shown in Figure 1. The cutting blades of the die consist of six strips of razor-blade steel sharpened on one edge. Each strip is six inches long, ¾-inch wide, and 0.009-inch thick.[4] They are clamped between metal spacers six inches long, ⅝-inch wide, and 0.245-inch thick, so that the cutting edges project ⅛-inch. The die is used in an arbor press or "clicking" machine.

With this device five strips 0.254-inch in width are cut simultaneously. This width was chosen for its convenience in determining the load to be applied to the specimen to obtain the desired stress based on the cross-sectional area of the unstrained specimen. The width is one-hundredth the numerical factor by which the thickness in millimeters must be divided in order to convert it to inches. Consequently the load, expressed in pounds, is equal to the numerical value of the thickness of the specimen measured in millimeters multiplied by the numerical value of the desired stress expressed in "hundredweights" per square inch. For example, to obtain a stress of 400 p.s.i., the load to be applied to a specimen 2.03 millimeters in thickness and 0.254-inch in width would be: $2.03 \times 400/100 = 8.12$ pounds.

### Bench Marker

Bench marks are placed 10 centimeters apart upon each specimen. This distance makes it convenient to measure elongation (strain) directly by means of a scale graduated in millimeters. The device used is essentially a metal bar with razor blades fastened on each end, as shown in Figure 2. In order to prevent cutting of the specimen by the blade, the edges are ground as shown in the detailed section. With this marker distinct lines not over 0.010 inch wide are easily made.

### Thickness Gage

The thickness of the specimens is measured with the gage shown in Figure 3. This gage has a dial indicator graduated in hundredths of a millimeter. One revolution of the pointer corresponds to 1.0 millimeter, and the total range of the indicator is 2.5 millimeters. The indicator is mounted above an especially constructed

[2] National Bureau of Standards, Washington, D. C.
[3] "Strain Test for Evaluation of Rubber Compounds," Frank L. Roth, Robert D. Stiehler, India Rubber World, 118, 3, 367 (1948).
[4] These blades were supplied through the courtesy of the Gillette Safety Razor Co., 125 Granite St., Boston, Mass.

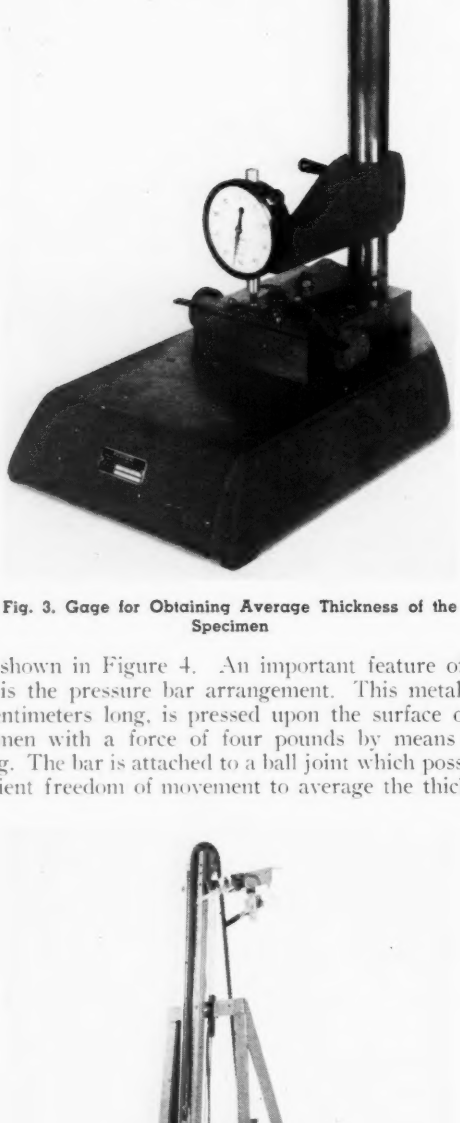


Fig. 3. Gage for Obtaining Average Thickness of the Specimen

base shown in Figure 4. An important feature of this base is the pressure bar arrangement. This metal bar, 10 centimeters long, is pressed upon the surface of the specimen with a force of four pounds by means of a spring. The bar is attached to a ball joint which possesses sufficient freedom of movement to average the thickness of wedge shaped specimens. The dial indicator is adjusted to read zero for specimens 1.50 millimeters in thickness, since specimens of this thickness require a load corresponding to the basic weight of the weight assembly described below under "Strain Tester." Additional thickness beyond 1.50 millimeters is read in hundredths of a millimeter.

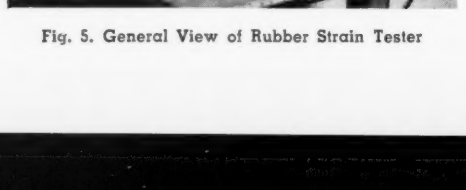


Fig. 5. General View of Rubber Strain Tester

## Strain Tester

The strain tester is designed to apply automatically the selected weights to a specimen to produce the desired stress, to provide means for measuring the elongation accurately and easily, to assure that measurement of elongation is made at the proper time after application of the load, and to return automatically the specimen and the tester to their starting positions after the measurement has been made. The design of the tester embodies mechanical and electrical features which are discussed separately.

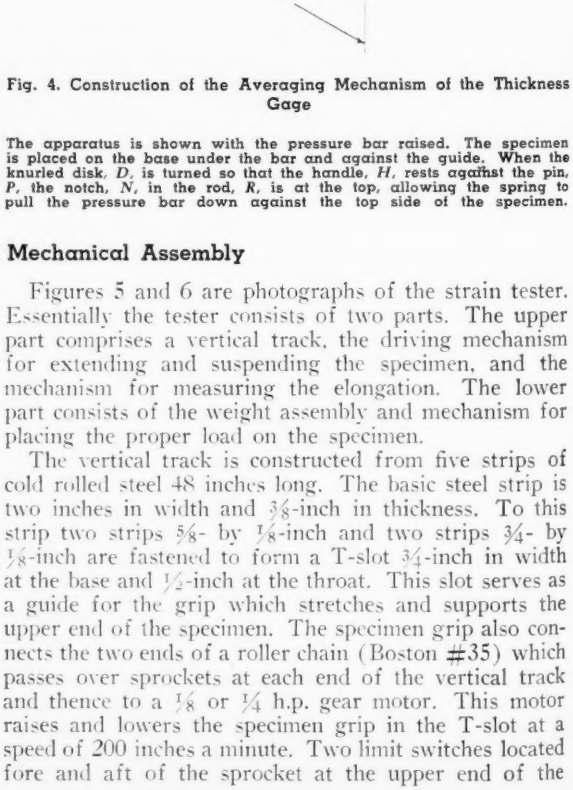



Fig. 4. Construction of the Averaging Mechanism of the Thickness Gage

The apparatus is shown with the pressure bar raised. The specimen is placed on the base under the bar and against the guide. When the knurled disk, *D*, is turned so that the handle, *H*, rests against the pin, *P*, the notch, *N*, in the rod, *R*, is at the top, allowing the spring to pull the pressure bar down against the top side of the specimen.

## Mechanical Assembly

Figures 5 and 6 are photographs of the strain tester. Essentially the tester consists of two parts. The upper part comprises a vertical track, the driving mechanism for extending and suspending the specimen, and the mechanism for measuring the elongation. The lower part consists of the weight assembly and mechanism for placing the proper load on the specimen.

The vertical track is constructed from five strips of cold rolled steel 48 inches long. The basic steel strip is two inches in width and 3/8-inch in thickness. To this strip two strips 5/8- by 1/8-inch and two strips 3/4- by 1/8-inch are fastened to form a T-slot 3/4-inch in width at the base and 1/2-inch at the throat. This slot serves as a guide for the grip which stretches and supports the upper end of the specimen. The specimen grip also connects the two ends of a roller chain (Boston #35) which passes over sprockets at each end of the vertical track and thence to a 1/8 or 1/4 h.p. gear motor. This motor raises and lowers the specimen grip in the T-slot at a speed of 200 inches a minute. Two limit switches located fore and aft of the sprocket at the upper end of the

track prevent the specimen grip from reaching the sprockets and damaging the tester.

A steel tape graduated in millimeters is used to measure the elongation. Since the bench marks are placed on the specimen 10 centimeters apart, each millimeter of extension corresponds to an elongation of 1%. Two transparent plastic positioners with hair lines are used to locate the position of the bench marks on the millimeter tape. The end of the tape is fixed to the upper positioner, and the zero point on the tape is adjusted exactly 10 centimeters below the hair line on this positioner. Thus, when the positioners are placed on the bench marks, the elongation is read from the tape at the lower positioner directly in per cent. To permit the

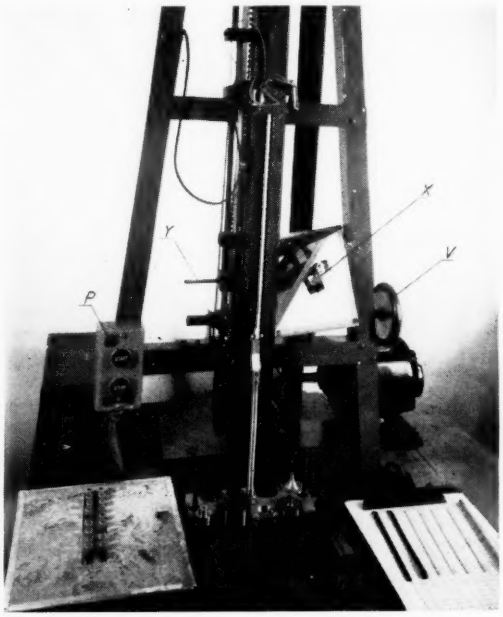



**Fig. 6. Rubber Strain Tester from the Perspective of the Operator**

*P*, pilot in series with motor of time-cycle controller
*V*, hand-wheel for aligning upper positioner with upper bench mark
*X*, prism and specimen as seen in plane mirror
*Y*, handle for rotating positioners to the specimen and aligning the lower positioner with the lower bench mark

operator, when seated at the tester, to locate the hair line of the upper positioner on the upper bench mark, arrangement X in Figure 6 is made to observe the hair line and the bench mark by means of a fixed plane mirror and a reflecting prism attached to the upper positioner. Lights attached to the prism illuminate the upper bench mark during the time an observation is to be made. The upper positioner, prism, and lights are moved up or down by means of a ladder chain and sprocket assembly. The assembly is driven by means of a hand wheel, V in Figure 6, within easy reach of the seated operator. The lower positioner slides freely on a vertical square bar which serves as a guide for both positioners and rotates them away from the specimen. A handle, Y in Figure 6, on the lower positioner enables the operator to slide it and to rotate both positioners to the specimen in order to make observations without parallax.

The lower part of the apparatus, consisting of the weight assembly and weight loading mechanism, is centered around a plumb line from the upper grip. The weight assembly passes freely through a rectangular hole five by eight inches cut in the table top which supports the

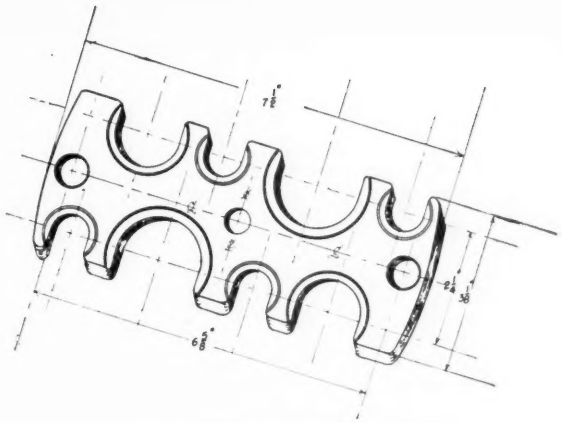


**Fig. 7. Holder for Additive Weights**

upper and the lower parts of the apparatus. The assembly consists of an aluminum rod (approximately 32 inches long) on which are fastened two weight holders, one at the lower end for the fixed weight and the other about 24 inches above for the additive weights. At the upper end of the rod is fastened the grip for the lower end of the specimen. The holder for the additive weights is constructed as shown in Figure 7. Guide rods pass through the holes in the ends of the weight-holder, and the additive weights are placed in the semi-circular notches on the sides.

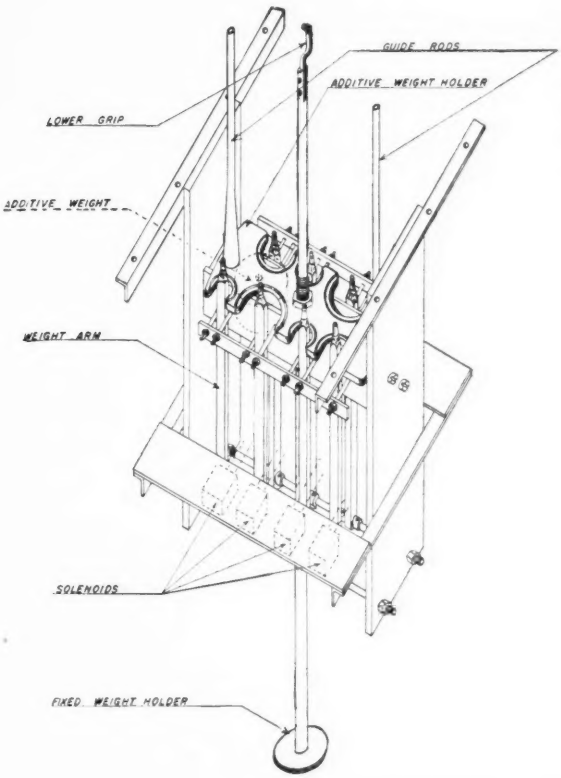



**Fig. 8. Weight Assembly and Loading Mechanism**

The weight arms are shown in their vertical position. In operation there are never more than four arms in this position at one time. One of the additive weights is shown by dashed lines in position on the weight arm.

The combination of the weight assembly and weight loading mechanism is shown in Figure 8. The eight additive weights are supported on arms normally inclined at an angle of about eight degrees from the vertical. When additive weights are needed, the arms supporting the selected weights are moved to a vertical position. The additive weights are then lifted from the ends of the arms by the upward movement of the weight holder at the time the specimen is elongated. The weights are returned to the arms during the retraction of the specimen.

The arms are moved to the vertical position by means of solenoids and returned to their normal position by the action of a coil spring after the circuit to the solenoid is broken. The mechanism for actuating the solenoids and the mechanism for indicating when the weight assembly is suspended freely are discussed in the section on the electrical circuit.

## Electrical Circuit

The mechanical operation of the tester is controlled by the electrical circuit shown in Figure 9. The part of the circuit which controls the weight loading mechanism utilizes eight solenoids, *S*, (Guardian No. 12 AC) for moving the eight weight arms into their vertical positions and 18 normally open switches for selecting the proper solenoids to apply the desired load. The keys operating the switches are locked by means of an additional solenoid, *K*, while the weight assembly is suspended. During the time the switches are free to be changed for selection of the desired load this part of the circuit is not excited.

Four of the solenoids are controlled by one decade of switches and the other four by a second decade. Four switches of each decade are single-pole, single-throw and control individual solenoids. Five other switches of each decade are either double-pole, single-throw or split-contact-throw (Micro-Switches BZ-3YLT were used) and control appropriate combinations of two solenoids. Thus with four weights the selection of any additive load in a decade is obtained by closing one of nine switches. One decade can adjust the load to correspond to specimen thicknesses from 0.1- to 0.9-millimeter in steps of tenth-millimeter, and the other decade from 0.01- to 0.09-millimeters in hundredth-millimeter steps. Thus the two decades can adjust the load for specimen thicknesses ranging from zero to 0.99-millimeter in hundredth millimeter steps. To close these switches it is convenient to use two decades of keys and the keyboard mechanism from a Friden calculator. This assembly is arranged so that the closing of one switch in a decade opens the others. The keyboard mechanism also provides a convenient device for locking the keys while the tester is in operation.

The electrical circuit which controls the weight loading mechanism is excited when the main relay (4PST, 110-volt AC, 6-ampere) is closed. This relay is closed by pressing the start button at the start-stop station. Once closed, the relay remains closed until the circuit to its exciting coil is broken either by the action of the limit switch, *L*, which opens when the upper grip returns to its starting position, or by the pressing of the stop button by the operator. Besides exciting the circuit controlling the weight loading mechanism this relay starts the motor which lifts the upper grip and stretches the specimen.

When the weight assembly is freely suspended a single-pole, double-throw precision snap switch, *W*, mounted on the weight loading mechanism starts the motor, *M*, on a time cycle controller. The function of the other position of this double-throw switch is to actuate a signal which is described along with the signaling devices.

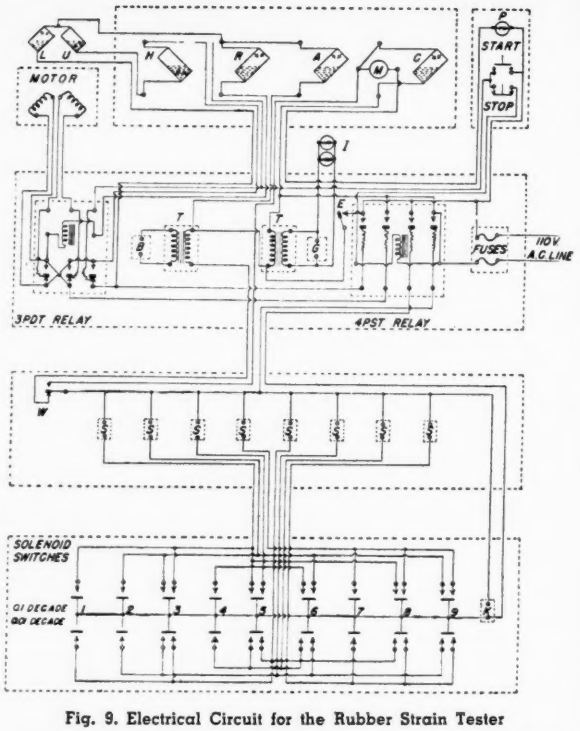



**Fig. 9. Electrical Circuit for the Rubber Strain Tester**

**The positions of the switches and relays shown in the circuit are for the tester at rest.**
*A*, switch for actuating single-stroke bell or gong, *G*, and lamps *I*
*B*, bell or buzzer
*C*, switch for stopping motor, *M*
*E*, switch for manual operation of lamps, *I*, when the tester is not in operation
*G*, single-stroke bell or gong
*H*, switch for limiting the lift of the weight assembly after switch, *W*, is released
*I*, lamps for illuminating upper bench mark during the observation period
*K*, solenoid for locking the keyboard
*L*, switch for opening 4PST relay when upper grip returns to starting position
*M*, time cycle controller motor
*P*, pilot-light for motor, *M*
*R*, switch operating 3PDT relay to return upper specimen-grip to rest position at end of test
*S*, solenoids for moving weight arms to their vertical position
*T*, bell transformers
*U*, switch for limiting upward travel of the upper grip
*W*, SPDT switch for starting motor, *M*, and, when weight assembly is not freely suspended at time of measurement for ringing bell, *B*

The sequence of operations after the weight assembly is freely suspended is controlled by a time cycle controller (Electric Switch Corp. Model 602). This controller consists of four mercury switches which are opened and closed by the action of cams rotated by a synchronous, clock motor, *M*. The functions of the mercury switches are as follows:

1. The height switch, *H*, limits the height to which the weight assembly may be raised (approximately eight inches).

2. The signal switch, *A*, operates an alarm which indicates the time the measurement of elongation is to be made.

3. The reversing switch, *R*, actuates a three-pole double-throw relay which reverses the motor at the end of a test, permitting the specimen to retract and the weight assembly to come to rest.

4. The cycle switch, *C*, stops the time cycle controller at the end of the cycle. The four switches open and close at the following points in the revolution of the cams:

| Switch | Opens | Closes |
|---|---|---|
| 1 Height | 9 degrees | 355 degrees |
| 2 Signal | 284 degrees | 248 degrees |
| 3 Reversing | 355 degrees | 293 degrees |
| 4 Cycle | 360 degrees | 5 degrees |

A rotation of 360 degrees requires 80 seconds. To indicate when the controller is in operation, a pilot lamp, *P*, (six volts, 0.15-ampere) is connected in series with the motor.

The signal switch of the controller closes the primary circuit of an eight-volt transformer, *T*. Connected to the secondary of the transformer is a single-stroke bell or gong, *G*, which serves to indicate when the elongation of the specimen is to be observed. The lamps, *I*, which illuminate the upper bench mark are connected to the same circuit. If the weight assembly is not freely suspended at the time the observation is to be made, the double-throw switch, *W*, attached to the weight loading mechanism connects a second transformer into the signal switch circuit. Connected to the secondary of this transformer is a vibrating bell or buzzer, *B*. This signal warns the operator that the observation is in error.

One of the limit switches, *U*, on the vertical track is used to protect the tester in case a specimen has an elongation greater than the limit of the tester or breaks before the motor of the time cycle controller starts. The other limit switch, *L*, breaks the circuit to the coil of the main relay at the end of each test when the upper grip returns to its starting position. This action breaks all the circuits except the one to the motor of the time cycle controller.

A switch, *E*, is provided for manual operation of the lamps, *I*, when illumination is desired for purposes other than the normal operation of the tester. For an example, illumination is required when the zero position of the steel tape is being initially adjusted relative to the hair line on the upper positioners. This adjustment is conveniently accomplished by use of a separate millimeter scale held in the position of the specimen.

## Method of Operation

Three steps are involved in the strain test procedure: namely, (1) the preparation of the test specimen from a rubber vulcanizate, (2) the measurement of the cross-sectional area of the specimen to determine the load to be applied, and (3) the measurement of the elongation of the specimen at a definite time after the load is applied.

### Preparation of Specimen

From the usual test sheet of rubber vulcanizate six inches square and about 0.075-inch in thickness five specimens are cut by means of the die described previously. Using the marker described, bench marks ten centimeters apart are placed upon each specimen. The marking compound should be of a contrasting color to that of the specimen; e.g., if the specimen is dark in color, red or white marks are convenient.

### Determination of Load

If the die is properly constructed and in good condition, the width of each specimen will be 0.254-inch (6.45 millimeters) to within 0.001-inch. Then only a measurement of the average thickness of each specimen by means of the gage also previously described is required to determine the cross-sectional area.

For measurements at a stress of 100 p.s.i., changes in thickness will require changes in load, in pounds, which are numerically equal to the thickness in millimeters. Consequently, by setting the zero position of the dial gage to the numerical value of the fixed weight one needs merely to make the additive weights equal to the dial reading obtained with the different specimens. To obtain the same convenient arrangement at 200 p.s.i. the fixed load and each additive weight must be doubled. This doubling is accomplished by the substitution of a different weight assembly. Analogously weight assemblies corresponding to any other desired stress can be used, if desired. Alternatively the fixed weight can be manually adjusted for each stress, and a table used to obtain the key board settings corresponding to different dial gage readings.

### Measurement of Strain

The specimen is placed in the grips of the tester by the operator with the bench marks facing him. After depressing the proper keys controlling the additive weights, he presses the start button. This action engages the appropriate additive weights and stretches the specimen. The pilot-light indicates when the weights become freely suspended and the time cycle begins. Fifty-five seconds later when the signal sounds, the operator holds the positioners against the specimen with his left hand and superimposes the hair line of the upper positioner on the upper bench mark by turning the hand wheel with his right hand. After this positioner is adjusted he superimposes the hair line of the lower positioner on the lower bench mark by sliding the positioner with his left hand. Approximately eight seconds are allowed for these two operations. The operator observes the elongation in per cent. directly from the position of the hair line of the lower positioner on the millimeter tape. There is ample time to observe and record the elongation while the upper grip and weight assembly return automatically to their starting position. A new specimen can be inserted and the keys changed while the controller completes its cycle. Thus each specimen requires about 1½ minutes of machine operation. The operator, however, has about one minute of this time free during which he could either operate a second machine or prepare specimens for measurement.

## Comments on Performance

The strain tester constructed in this laboratory has operated very satisfactorily for more than a year. In the usual stress-strain measurements the errors in testing have been found to be of the same order of magnitude as those arising in the preparation of the vulcanizate. On the other hand it has been found that the errors of testing with the strain tester are negligible in comparison to those arising in the preparation of the vulcanizate. This improvement in precision and accuracy of testing has been useful in both control and research testing. Data showing the improvement of precision were omitted from this paper, since they were part of a separate publication[3] dealing with the use of the strain test for the evaluation of rubber vulcanizates.

An advantage of this test in addition to the improved testing is the reduction in manhour requirements. This reduction is due in large part to obtaining the data in tabular form at the time of the test. At the same time the ease and convenience of the test has improved the morale of the testing personnel. The operation of the tester from a sitting position, the ease of changing weights, and the elimination of following two moving bench marks simultaneously have been the prime factors in this respect.

(*Continued on page* 578)

[3] India Rubber World, 118, 3, 367 (1948).

# Positex[1]

ABOUT ten years ago C. M. Blow, working at the Wool Industries Research Association on investigations being carried out in collaboration with the Technical Research & Development of New Uses Committee of the Rubber Growers' Association, London, found that by the use of a cationic soap, negatively charged *Hevea* latex can be converted into positively charged latex. This discovery is of particular interest to the textile industry, for with textile fibers being negative to an alkaline aqueous medium, the new latex with positive charge, which has been given the name Positex, is peculiarly suited to treat them.

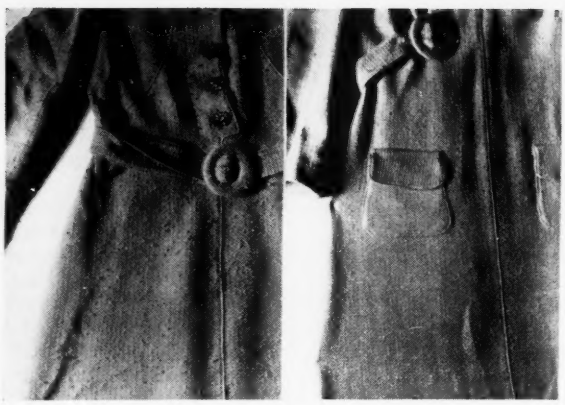
This fact is well illustrated by a comparison of results obtained by treating samples of yarn with Positex and normal latex. If a hank of well-scoured soft-twisted worsted yarn is immersed into a bath of normal latex, no absorption of rubber takes place. But if a similar hank of yarn is immersed into a Positex bath and kept gently moving by hand or mechanical means, in a few minutes the yarn begins to take up the rubber and continues to do so until no rubber is left in the bath and the liquid is water-clear. If the treated yarn is then removed, hydroextracted, and dried, it will be found that the applied rubber is deposited as discrete particles and not in the form of a continuous film. That the deposition is uniform is noted if a pigmented Positex bath is used.

As the above test suggests, the properties of Positex offer several advantages in production: the amount of rubber deposited is very easy to control, and anything up to 25% can be so applied, though the usual amount is from 10 to 15%, and for certain purposes satisfactory effects are obtainable with a deposition of only 5% to 7% of rubber. Drying is simplified because most of the water can now be removed mechanically. Finally, since the rubber is deposited uniformly, yarn can safely be treated in the form of hanks or cheeses.

Besides the above advantages, the use of Positex improves textile fibers and also makes novelty effects possible. Since the rubber acts as a binder, holding individual fibers together and thus preventing them from slipping over each other, a soft-twisted yarn treated with Positex acquires the tensile strength of a hard-twisted yarn so that a fabric with softer and more luxurious handle, and one that retains its shape better, can be produced without loss of strength. Furthermore the loss of fiber which is responsible for wear in fabrics, and the related effects, such as balling up or pilling in soft woven or knitted woolen garments, are markedly reduced by rubberizing with Positex. The ability of the new latex to improve these properties makes it especially valuable for use in the manufacture of carpets, where it increases wear-resistance; in the preparation of felts from non-felting fibers as cotton, jute, etc., which retain their air permeability because Positex is not deposited as a film, but as discrete particles, a fact which can be of very great importance for certain applications; and in obtaining decorative effects on fabrics. Positex can also be used as a vehicle for pigments, scents, mothproofing agents, water-repelling substances, and the like. Indeed, because of the presence of cationic soap, Positex proofs wool and jute against mold and to some extent also mothproofs wool.

[1]Prepared by the editors of India RUBBER WORLD from "Positex" bulletins Nos. 1-6, published by British Rubber Development Board, London, England.

[2]Manufactured by Imperial Chemical Industries, Ltd.



**Two worsted knitted garments after being worn for the same length of time by the same individual. The garment on the left is made from normal yarn and shows bad loss of shape, wear, and surface pilling of the fibers. The garment on the right is made from rubberized yarn and shows no pilling of the fibers, but much improved wear and retention of shape.**

Finally, Positex serves as an adhesive, since, unlike normal latex, it has an affinity for certain textiles and can be used as an anchoring medium to give a better bond between rubber and a fabric which does not normally adhere well to a spread film, or when it is desired to secure good adhesion between crepe rubber and felt.

It must be emphasized that, since rubber deposited from Positex is not in the form of a continuous film, Positex treatment is not a waterproofing process, nor does it increase the normal elasticity of a yarn or fabric, though because it permits looser structures, as in the case of felts, for instance, its use does impart a certain resiliency.

## The Compounding of Positex

Positex is supplied in two grades—vulcanized and unvulcanized—which consist substantially of the appropriate rubber dispersed in water together with the cationic soap required to reverse the charge. For certain purposes these products must be compounded like normal latex, and in these cases care must be taken to add ingredients which are chemically compatible with the constituents of Positex, and they must be given a positive charge before addition.

For the dispersion of ingredients with positive charge, 20 parts of the solid compound, one part of cationic soap (preferably Vulcastab T.M.[2]) and water to give a dispersion of 25 to 50% content are worked in a ball-mill. Substances which give dispersion containing flocculated particles should be rejected.

Tests indicate that the following ingredients are suitable for use in Positex:

- Mineral Fillers
  - Titanium oxide
  - China clays (except Bentonite)
  - Zinc oxide
  - Whiting
- Mineral Colors
  - Ultramarine blue
  - Chrome green
  - Red iron oxide
  - Cadmium sulfide (yellow)
- Black
  - P-33
- Waxes and Oils
  - Paraffin waxes and mineral oils, such as liquid paraffin, can be emulsified using 5% cationic soap.

Scents and Deodorants

As available for rubber.

Organic Coloring Substances

Most of the organic colors sold for latex do not disperse satisfactorily by the above procedure, but prepared colors in the form of pastes containing the cationic soap and ready for addition to Positex are being developed.

Antioxidants

Positex contains an antioxidant. Flectol H disperses satisfactorily.

The following substances commonly used with normal latex are incompatible with Positex:

Negatively charged dispersions.

Common soaps and the newer detergents, wetting and dispersing agents (anion-active substance).

Saponin, vegetable oils and waxes, proteins, glues, gelatin, and starches.

Crystal gums, gums tragacanth, Arabic and Karaya.

Active clays (Bentonite), colophony, resins, pine tar and pitches.

Agar and albumen; sodium alginate and sodium silicate, phosphates including Calgon, phenol, sodium pentachlorphenate (Santobrite-Monsanto).

It has not been found possible to produce a vulcanizable Positex which is stable for more than a week or two; therefore a generally useful vulcanized Positex has been developed, which is stable. For certain purposes, however, a soft rubber vulcanizable Positex may be essential; for others, an ebonite compound is required. In such cases suitably compounded Positex should be made as required, but it will remain stable for only a week or so under normal conditions. Zinc oxide and sulfur as well as certain water-insoluble accelerators used for latex can be dispersed satisfactorily in a ball-mill, as Butyl Zimate, Vulcafor ZDC[2], Ethyl Zimate, Ethasan, Methasan, Methyl Zimate, Vulcafor TMT[2], Methyl Tuads, and Thiurad.

Suitable formulae for soft rubber and ebonite compounds are given below:

Compound A—Soft Rubber

| | |
|---|---|
| Sulfur | 18 |
| Zinc oxide | 14 |
| Butyl Zimate | 6 |
| Flectol H | 12 |
| Vulcastab T.M. 50% paste | 5 |

[one pt. per wt. (of solid) should be added per 100 pts. of 20% unvulcanized Positex]

Compound B—Ebonite

| | |
|---|---|
| Sulfur | 38 |
| Zinc oxide | 8 |
| Vulcafor ZDC | 4 |
| Vulcastab T.M. 50% paste | 5 |

[10 pts. by wt. (of solid) should be added per 100 pts. of 20% unvulcanized Positex]

After deposition, Compound A will need heat treatment for about 60 minutes at 70-100° C., and Compound B two to four hours at 100-120° C. to complete vulcanization to soft rubber and ebonite respectively.

As thickeners, Tragasol[3] (locust bean gum) and methyl cellulose are compatible with Positex if care is taken in mixing; white dextrin can be used in small quantities (up to 10% on the rubber).

Because of the presence of the cationic soap, rubber from Positex tends to absorb about 5-10% water, which in certain cases can be a disadvantage. Water absorption can be considerably reduced by treating rubber-coated material with a dilute solution of sodium hexa metaphosphate (Calgon) which forms an insoluble complex with the cationic soap.

If for any reason it should become necessary to remove rubber from fibrous material, this removal can be effected by a tepid dilute soap and soda scour with plenty of mechanical action, provided the rubberized material has not been finally dried. But if the rubber has dried on, its removal requires first that the material be impregnated with a suitable catalyst, such as cobalt linoleate, dried off, and then heated at 70° C. for one or two hours in a current of air to oxidize the rubber sufficiently to permit its removal by use of a soap and soda scour.

[3]Tragasol Products, Ltd.

### Preparation of Material for Treatment

Before a yarn is treated with Positex it should be freed of any trace of oil or grease, particularly vegetable oils and fats which will form soaps with alkali, and it should be freed of soaps by a very thorough scour and rinse. A precipitate of calcium soap on the yarn renders it hydrophobic, and the calcium soap dissolved by the Positex bath upsets the stability of the latter.

For deposition to take place the yarn as well as the Positex bath should be alkaline, with a pH between 8.5 and 9.5.

The preliminary treatment is necessary to insure slow and complete exhaustion of the rubber by the yarn, with the rubber deposited on the fibers as a fine, almost undetectable coating.

### Treatment of Fabrics

As already indicated, yarn is immersed into a suitable Positex bath and gently kept moving by hand or mechanical action. After the yarn, which may be in the form of hanks or cheeses, has absorbed all the rubber, it is removed from the bath, hydroextracted and dried. When a high percentage of rubber is to be deposited on the yarn, this result can be attained by successive immersions into dilute baths; the yarn should be hydroextracted after each immersion.

Fabric is treated by spraying on or padding on Positex; then it is festooned, batched on to a roller, or cuttled. Exhaustion takes place; the rubber is deposited, and the fabric hydroextracted to remove the clear liquid, dried, and tentered.

Exhaustion should be slow and complete, as already explained, and the rubber should be deposited on the fibers in fine discrete particles. But sometimes abnormalities occur; there may be visible flocculation of the particles in the bath at some stage of exhaustion, or exhaustion may be very slow and incomplete, or the rubber may be deposited in abnormally large particles. Careful attention to pretreatment of the yarn, temperature, and pH of yarn and bath will help to prevent these faults. In other cases, the rubber leaves the yarn after partial or nearly complete exhaustion; reversion, as this phenomenon is termed, may be due to chemical or mechanical causes. In the open structure of a yarn or fabric a large volume of liquid is retained, and removing it creates eddies whereby the mechanical force on the rubber particle becomes greater than the electrostatic force holding it to the fibers, with reversion the result.

### Effects of Processing

Tests to determine the effects of the various kinds of processing that yarns and fabrics must undergo show, first, that yarn or fabric treated with Positex will lose a proportion of the deposited rubber if they are immersed into another liquor before being dried. Alkaline treatment after the material has dried will remove only a small portion of the rubber, especially if the soap content is kept low; milling shrinkage and the amount of cover raised on a cloth during milling are reduced by Positex so that a more compact and resilient fabric is obtained by its use. In the case of wool, wet chlorination has hardly

any effect on the rubber; while sulfur dioxide and hydrogen peroxide bleaching are without serious effect on the rubber if an antioxidant is present in the rubber. But dry chlorination is not advisable because chlorine gas tends to react with the rubber to produce a resinous product that will adversely affect the handle of the material. As to cotton yarns, mercerization and bleaching adversely affect the deposition of rubber, and yarns so treated should not be rubberized with Positex.

From the weaving point of view the rubberizing treatment does not eliminate the need of sizing, as it does not lay the surface fibers in the manner that starch and glue do. Small-scale trials in knitting rubberized yarns have met with some degree of success, but further trials are necessary to prove that there are no serious complications. Experiments show that these yarns are quite suitable for obtaining fancy knitting and reverse plating effects on coarse gag machines.

Provided the material is dried off after rubberizing, only a slight loss of rubber takes place in a normal dyeing operation. In general the presence of the rubber does not interfere with dyeing of the fibers, though under certain circumstances and with certain dyestuffs the presence of the cationic soap may cause some anomalous behavior, such as more rapid exhaustion of the dyebath than usual, formation of scum, variation of shade, etc. These effects can be overcome by adding a small amount of one of the newer detergent or wetting agents (anion active) to the dyebath at the commencement of the process.

### Positex Printing Pastes

Vulcanized Positex can also be used as a printing paste to produce novel effects, provided it is first thickened by incorporating Tragasol or methyl cellulose. A fabric which has a design printed on with Positex can be given an embossed effect if the fabric is put through a brushing machine which will raise the surface everywhere except where the Positex has been applied.

The paste can be pigmented by the addition of suitable colors carrying a positive charge and dispersed in water. Printing of Positex pigmented white on to a dyed fabric will give a half-tone effect due to the masking action of the white rubber on the dyed fibers; similarly the use of Positex pigmented with one color on a fabric of another color will produce effects which may appeal in certain directions.

The rubber will not interfere with subsequent dyeing of the fiber, provided conditions are kept alkaline and suitable dyestuffs are selected. Positex and dyestuff can be printed from the same paste in one operation. However the cationic soap in Positex will influence the affinity of fibers for certain classes of dyestuffs so that if a fabric is printed with Positex and subsequently piece-dyed, the printed portions may assume a different shade. This result can be made use of to produce new effects or can be completely eliminated by the use of a small percentage of a sulfonated alcohol soap in the dyebath.

### Wear Resistance

Vulcanized Positex is unlikely to be affected by pressing and setting though high pressure and high temperature together should be avoided. The aging qualities of Positex are adversely affected by contamination with copper and manganese, and these also should be avoided.

In time a certain harshness may develop in material as a result of the oxidation of rubber, a harshness that develops more slowly and is less marked in material constantly in use than in material allowed to lie dormant for lengthy periods. However the oxidized rubber can be removed by soap and soda scour without rendering the material unserviceable. Since it is in the early stages of the serviceable life of a material, before matting and locking of the fibers takes place that rubber is required to prevent loss of fiber, later loss of rubber is not considered so important as the rubber has already served its primary purpose.

### Tests with Other Fibers

Other fibers investigated, in addition to wool and cotton, include jute, sisal, rayon, and linen. Financial considerations prevent the development of Positex treatment of jute since hessian, sacking, and like products made from jute do not command a sufficiently high price to warrant the addition of rubber. The effect on filament rayon is such as to rule out its use here, but Positex will have application to spun viscose and to mixtures containing this. Little work has as yet been done on linen. As to sisal, the use of Positex as pretreatment prior to incorporation of larger amounts of rubber is suggested.

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## Formation of Vulcanizates

*(Continued from page 512)*

The authors are indebted to the National Research Council of Canada for financial assistance, and to the research staff of Polymer Corp., Sarnia, for the preparation and physical testing of the vulcanizates.

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**"Reactivity and Structure of Dienes and Their Polymers.** Part I. Reactivity of Pi-Complex Compounds. Part II. Synthetic and Natural Rubber." G. Salomon Rubber Stichting, Delft, Holland. Communications Nos. 76 and 77. 22 pages. Pi-complex compounds is the name proposed for labile molecules formed by the interaction of pi-electrons in unsaturated systems with a second molecule or ion. Part I discusses factors influencing the strength of the bond and points out that a better understanding of the labile molecule is essential for further development in polymer chemistry. Part II discusses the efficiency of inhibiters and initiators on the homogeneous polymerization of dienes and differences in the properties of polymers from butadiene, isoprene and 2,3-dimethylbutadiene.

# Postwar Packaging and Shipping of Plantation Rubber and Their Effect on Quality

H. W. Courtney[1]

**THIS article by one of the partners of a firm of marine cargo surveyors, who has been connected with the importation of crude natural rubber for a number of years, is noteworthy in that it presents an up-to-date analysis of some of the reasons for the steady decline in the quality of natural rubber from the Far East since the end of the late war. It is important since Mr. Courtney might be classed as a disinterested observer for he does not buy, sell, or manufacture goods from rubber. His comments should be read with interest not only by those concerned with the importation and handling of natural rubber to which the article is primarily directed, but also by the producers and the consumers as well. Action to correct or compromise some of the difficulties certainly seems indicated. Editor.**

THIS article was originally written for those who have an interest in claims for loss or damage to shipments of plantation grades of natural rubber arriving from the Far East and records our observations on developments and conditions of packaging and shipping which we believe are responsible for the increase in the number and amount of claims. The present packing or packaging of plantation rubber is undoubtedly one of the major factors contributing to the increase in claims of importers against carriers and underwriters.

These claims, we believe, will fall into three general categories:

1. Damage due to contact with water or any other substance such as other cargo of a fluid or dry nature which affects the crude rubber adversely or is objectionable on the crude rubber as a foreign substance which must be removed before the rubber is used.
2. Crushing or unusual and extreme distortion of the package by superincumbent weight while in stowage in the vessel.
3. Loss due to shortage or non-delivery of entire shipping packages.

### History of Packing Crude Rubber

The type of packing for given grades and types of plantation rubber from the Far East has changed considerably during the past 25 years, but the trend has been consistently toward using less and cheaper packing material, culminating in the "bareback" bale in which there is no packing material. With this type bale the gross weight is the net weight of the crude rubber.

**The Period Prior to 1920.** Prior to 1920 practically all plantation grades were shipped in tea chests also known as "momi" chests. These containers were constructed of coniferous or local "red wood" lumber about ½-inch thick, box-jointed at the corners, and measured 19 by 19 by 24 inches. In these chests ribbed smoked sheets were packed to 224 pounds net, crepe grades usually to 140 pounds net or thereabout, depending on type.

The chests or cases formed a supporting structure about the rubber, and the weight of cargo stowed above them was borne by the cases; so crushing was practically unknown. The shipping marks were clearly stenciled on the cases, and shortage and non-delivery of packages were, in comparison with the situation at the present time, negligible. Damage by water or contact with other substances was also less for a given tonnage since the cases provided some protection from this type of difficulty.

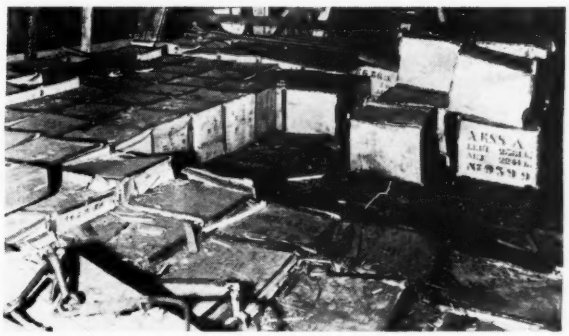

**Fig. 1. Rubber in Wooden Cases Which Have Become Generally Crushed and Broken Owing to the Weight of the Cargo above Them and Insufficient Strength to Withstand This Weight**

**The 1920-1930 Period.** In the early 1920's three-ply veneer "tea chests," 19 by 19 by 24 inches, with edges protected with tin binding stapled or riveted to internal stiffeners at the corners and framing top and bottom came into increasing general use. The best of these packages, of Finnish origin, weighed 16 pounds; the lightest and poorest, of Japanese origin, weighed 13 pounds. These cases also formed a supporting structure about the rubber, and the better cases carried the weight of the cargo above them very well. The poorer cases, however, failed in this respect in many instances and broke under the weight of cargo, particularly during periods of heavy weather when the pitching and rolling of the ship placed an abnormal strain on the cases. (See Figure 1.) Pieces of the cases were driven into and adhered to the rubber.

During the period of the 1920's, the practice of shipping lower-grade crepe rubbers from the Dutch East Indies in matting-covered bales, bound and held together by three wires or three machine drawn metal straps, came into being. Subsequently packers in the Straits Settlements and in Ceylon began to ship ribbed smoked sheets and crepe rubbers in burlap covered bales, or, in the case of Ceylon, in covers composed of reused gunny sacking from rice bags. These matting and burlap covers were advantageous from the shipper's point of view, since they were cheaper packaging material, required less labor, and contained more rubber by weight per shipping ton (40 cubic feet), and therefore resulted in a reduction in the freight cost per shipping ton.

**The 1930-1935 and Prewar Period.** The trend away from cases to bale covering with either burlap or matting increased during the depression years of 1930-1935 when there occurred a decline in the price per pound of No. 1 ribbed smoked sheet rubber to the all-time low of about 2½¢ in the New York market. With the increase in the price of rubber during the following years, the covered

[1]Johnson & Courtney, cargo surveyor and appraisor, New York, N. Y.

bale form of packing still continued to be used in more and more instances because of its convenience and low cost. We would estimate that just prior to World War II at least 70% of the plantation rubber from the Far East was being shipped in burlap or mat covered bales. Of the remaining 30%, we would estimate that 20% of the total was being shipped as "bare-back" bales, viz., no packing at all for ribbed smoked sheets, and the crepe grades shipped in uncovered bales bound by three wires or three machine drawn straps with shipping marks stenciled on a burlap marking patch at one end of the bale.

Of course during World War II the importation of plantation rubber from the Far East came to a standstill, but with the end of hostilities imports were resumed.

**The Period Postwar to Date.** Because of the world shortage of burlap and practically all other such packing material during the postwar period, the trend to "bare-back" packing was greatly accelerated for smoked sheets and was even extended to thin crepes. Blanket crepe types do not lend themselves to bare-back packing and are still shipped with or without matting covers, bound with three machine drawn straps. If shipped without matting, blanket crepe has a burlap marking patch at one end. At present we would estimate that 90% of the ribbed smoked sheets are shipped bare-back with the exterior of the bale coated with a whitish compound in liquid form brushed on the bales and with shipping marks stenciled on the bale after the compound dries. Some lower grade ribbed smoked sheets are shipped from the Dutch East Indies in matting covers sewn at the seams; some with the rubber bound with machine drawn straps, and some without straps.

Rubber packed in cases is a rarity today except for sole crepe, and this type of rubber constitutes a very insignificant part of the total rubber imports.

### Handling on Shipboard—Crushing

During this period when the packing of plantation rubber has changed from the use of cases to bales and to no packing at all, the ships used to transport the rubber have remained substantially the same and carry about the same tonnage. When the rubber was packed in cases, it stowed uniformly, and the cases supported the weight of the cargo above them; now, however, the weight of the rubber cargo is supported only by the rubber itself.

Baled rubber is customarily stowed on its side and presents a surface of about 18 by 24 inches, or approximately three square feet. Thus, if bales of ribbed smoked sheet rubber weighing 250 pounds net per bale, are tiered 21 high in a ship's compartment, total weight of 20 bales stowed over the bottom bale is 5,000 pounds and exerts a dead weight pressure of 1,666 pounds per square foot on the bottom bale. This dead weight is unquestionably a minimum weight as a vessel under way and in a heavy sea will pitch and roll, and the stow of baled rubber in a compartment heaves and works with the ship's motion so that the lower tier bales are subjected to pressures far in excess of the dead weight pressure. Since rubber is resilient, lower tier bales are pressed and kneaded until they fill all free space in the stow and are pressed over and about the dunnage boards and other parts of the ship's structure. In addition, the bottom bales frequently adhere to each other and become a solid mass of rubber.

Before bare-back packing became so general the burlap or matting-covered bales also settled in the stow and spread so that all free space was filled, but the bale coverings prevented the adherence of bale to bale. On discharge at United States ports the bales could be landed as units or groups of bales; the only difficulty was that the covers were firmly adhered to the rubber.

At the present time the greater part of the plantation rubber arriving in this country is in bare-back or exposed form, and about 75% is of the types where, if the rubber in one bale comes in contact with the rubber in other bales while under pressure of stow, the bales adhere to each other. Vessel operators and importers and others are now faced with problems of handling and disposition which they did not have before the war.

Because of the settling of the rubber in the vessel and because it is pressed through and about dunnage boards and permanent dunnage in a vessel's compartments, through and about hatch ladders, stanchions, and other parts of the ship's structure, and also because of the adherence of the bales to each other, discarge is materially slowed down with the cost per ton of rubber unloaded correspondingly increased. This increased cost of unloading rubber at present results from the loss of freight money by the ship's owners for every extra day spent in discharging rubber cargo, increased berth charges, and greater fixed charges for wages of the crew, provisions, fuel, etc.

Bales of ribbed smoked sheets are frequently unloaded in masses weighing from one ton to five tons, which must then be laboriously pulled or cut apart on the pier by labor with power furnished by lift trucks or automotive cranes. This operation adds further to the cost per ton of rubber unloaded. Shipping marks stenciled on the coating or wrapper sheets of the bare-back bales are often lost so that many of the bales or parts of bales resulting from the separating operation can no longer be properly identified.

Shipping marks are also lost because of the setting, crushing, kneading, and working of the bare-back bales in the ship's hold, and this loss of markings makes it extremely difficult for the steamship company's sorters to separate bales according to their proper marks. In our opinion the sorters do a remarkable job considering the condition in which the bales are landed and the pressure under which they work with only a limited amount of time to identify each package. Another difficulty in identifying bales on discharge arises from the talc applied to the bales by the vessel's agents at the time of loading. This free talc dusted or shoveled on to the bales during stowing tends to cover shipping marks and necessitates removal before identification can be applied after discharge.

Under existing conditions, in order to get the cargo out of a ship and ready to sail again, it has become commonplace to bulk-pile a good portion of the rubber cargo and sort it at a later date.

This unavoidable incomplete and incorrect sorting has the result that representatives of consignees (usually weighers) must watch delivery of each lot and throw out or reject bales which do not belong in the lot. Thus when all available bales of a lot as tiered have been handled, usually the lot is short a number of bales ranging from a few bales to 224 or entire lots of 25 tons. Claims for shortage or non-delivery of lots therefore result.

When all available packages of rubber on a given vessel have been delivered, there usually remain on the pier bales of various types, grades, and condition in amounts ranging from 10 to 50 tons. The delivery departments of the steamship companies frequently offer some of these no-mark bales of rubber to importers' representatives, and sometimes the latter accept them to apply in whole or in part against shortages. The importer who is short, say, 50 bales in a lot, where the bales are packed 250 pounds net each, will not, however,

accept sound rubber of the same grade packed 224 pounds per bale, nor will he accept damaged rubber or rubber of a lower grade than that called for in the original lot.

Importers' representatives may, however, accept whatever is offered to them as smoked sheet rubber if the shipment they are concerned with happens to call for No. 5 grade, packed 224 pounds to a bale, since they will probably not suffer any great inconvenience or loss in such a case.

The result of all of these present practices is that agents of the steamship company accumulate claims for non-delivery, and they have to apply against these claims only a conglomeration of no-mark lower-grade packages and pieces of rubber, which becomes greater and greater following the discharge of each succeeding vessel from the Far East. Ultimately, if they cannot deliver this rubber to importers, they are forced to sell it on the open market for what they can get for it.

## The Problems of the Importer

It is a nuisance and an additional expense for the rubber importer to have a 100-ton lot short 10 to 50 packages and, at a later date, have the steamship company's delivery department state that it has found some or all of the original packages and that they are ready for delivery. The importer's representative must proceed to the pier and examine the packages, and, all too frequently, the delivery department of the steamship company has been over-optimistic as to the bales in question being the original ones. Even if they are and are in sound condition, shipment to the purchaser has to be arranged for at the higher less than carload rate, to to the warehouse for consolidation with some other lot, or they may have to be allocated to another factory as part of a carload.

In addition, underwriters receive from the importers claims for shortage or non-delivery of packages and are put to the expense of investigating these claims, and, even though the rubber may ultimately be found or replaced by grades acceptable to the importers and the claim withdrawn, an unusual amount of expense to the underwriter is involved.

Damage claims made by importers are a reflection of claims and complaints they receive from consuming factories. Examples received from manufacturers of rubber goods are as follows:

1. Distorted and out-of-shape bales will not tier properly in the warehouse; they consume more floor space and are a liability from the personal injury angle. (See Figure 2.)

**Fig. 2. Examples of Distorted and Out-of-Shape Bales; the Bale at the Top Center Has Been Indented Where It Was Forced Against Dunnage Wood or Spar Ceiling**

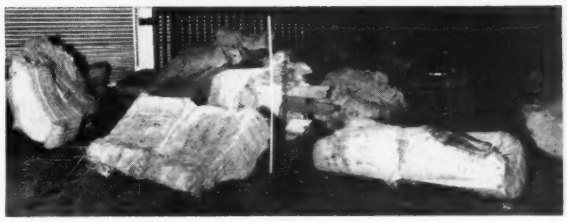

**Fig. 3. Crushed Bales and Bales Having Dunnage Boards and Palm Matting Embedded in Them**

2. Out-of-shape bales will not ride a conveyer belt to the cutter and must be guided. They will not feed to the cutter properly.

3. As a result of 1 and 2 above, there is a slow-down at the beginning of the production line which carries through the entire line and results in incalculable financial loss.

4. Even if management is reconciled to this slowdown of the production line, labor, working on a piece-work basis, is not and will refuse to handle a lot which slows them down and results in a loss in wages.

5. Crushed bales frequently have foreign matter embedded in them which must be removed at an additional labor cost. Removal is difficult and often incomplete, and an increased percentage of rejects or seconds in the finished products develops. If the seconds are not detected on inspection, imperfect goods reach the market, and further claims and complaints result (See Figure 3.)

6. Wood, lint, paper, or any other organic foreign matter on or in the rubber is liable to burn or oxidize in the vulcanizing process, causing bubbles or porosity in the finished product. In tires and tubes and many other products this type of difficulty is very serious.

7. Metallic foreign matter, such as straps, "C" clips which secure wires around bales, etc., have in some instances caused heavy damage to factory machinery. This difficulty constitutes the main objection to the wires and straps which become embedded in the rubber, since even if the protruding wire or strap is pulled out, the clip can remain in the rubber.

## Postwar Plantation Rubber Quality

Since the reopening of trade in plantation grades of rubber from the Far East, there appears to have been a steady decline in the quality of the rubber received in the United States, and this decline in quality has been proceeding at an increasing rate. Claims of importers on shippers for lower-than-contract quality and the necessity of settlement of these claims through the arbitration panel of The Rubber Trade Association, of New York, Inc., have been the result.

In comparison with former years, there is at present a flood of these arbitrations, and in the great majority of instances, the importer-buyer claims of lower quality than contracted for with the shipper-seller have been upheld, and price adjustments effected. Financial compensation for the lower-quality rubber, however, does not provide the importer with the higher-grade rubber he needs to deliver to a factory or to other dealers against his commitment.

The importer is obligated by his contract with the factory or other dealer to deliver a specified grade, such as No. 1 ribbed smoked sheet. He must therefore go into the spot or near futures market and try to buy the higher-grade rubber. He usually finds that other dealers

are in a similar position and are bidding for an inadequate supply of the higher grades of rubber and that the market is glutted with the lower grades. The natural result of this situation on the price of the different grades of rubber is a widening of the differential between the higher and the lower grades.

As a further complication, we might cite as an example the importer who received from the Far East, No. 3 ribbed smoked sheet instead of the No. 2 ribbed smoked sheet he contracted to buy and who obtained from the factory buying the rubber from him an extension of his delivery time in order to purchase for future delivery No. 2 sheet again. When the second order arrived in this country, it was found to be lower than No. 2 sheet quality also, and the importer now had doubled his troubles.

Consuming factories use certain grades of natural rubber for certain purposes as, for instance, No. 1 and No. 2 ribbed smoked sheet for automobile inner tube stock. The No. 3 smoked sheet is of no use to them for this purpose, and they have no interest in it even though it might be offered to them with a credit for the lower value.

A steamship company might ask of what interest is the quality of the rubber being shipped to him, but, as has been indicated in the above discussion, the steamship companies are, because of present conditions, now in the rubber business and have a real interest in this general decline in quality and the widening of the price differentials between the higher and the lower grades. The steamship companies almost invariably have lower grades to sell, and while formerly they might get ½¢ per pound off prime value for off-quality grade, today the differential is likely to be 2½ or 3¢ per pound.

The underwriter also might say that he had no interest in quality, but rubber which is damaged in transit from any cause is generally down-graded, and with the existing wide price differentials between grades the loss from this condition is greater than it was formerly.

The importers are in the position that with the large unwanted stock of off-quality rubber available, none of their customers or the consuming factories have any interest in such rubber unless it is offered to them at a very low (bargain) price. Allowances for damage in cents per pound asked by importers is therefore continually increasing for a given type and degree of damage. If underwriters' representatives feel that they cannot agree to these estimates of damage, which appear to them excessive, the importers state that it is the best they can do and suggest that the underwriters try to sell the rubber in the open market to better advantage. If the underwriter does put the lot in question on the market, he usually finds that there is very little interest; there are few bids, and those that are made are disappointingly low, and that he cannot better the price offered by the importer.

**Summary and Conclusions**

From the foregoing discussion it might appear that the producers, packers, and shippers of natural rubber in the Far East are the only ones, or at least the most likely ones in the chain of producer, shipper, carrier, importer-dealer, consuming factory, who could take steps to correct the troubles plaguing the trade in natural rubber and all those connected with it. The producers and the shippers are many and various, are widely separated and, so far as we know, with no common association or interest. Concerted action by shippers cannot be expected unless such action is brought about by some controlling economic factor.

It is reasonable to expect that producers of natural rubber will endeavor to produce as high quality as they can because they get higher prices for higher grades. It would therefore follow that there must be good reasons for their apparent present inability to deliver properly graded rubber. It would be the writer's guess that poor labor conditions, the decline in the number and experience of supervisory personnel, loss and depreciation of equipment and inability to obtain replacement of equipment even at higher prices, etc., are some of the factors contributing to the natural rubber producers' inability to delivery more of the better grades of rubber and to pack and ship them more adequately.

There was an article in a recent issue of India RUBBER WORLD to the effect that 1947 was a very poor year for rubber producers in the Far East. Current New York market prices for crude natural rubber are no doubt considered by the producers in the Far East as very low in relation to their increased costs of production. Hence the producers probably feel individually and collectively that they are in no position to increase their packing costs.

If the producers of natural rubber cannot supply the quality that the consuming factories have been accustomed to and have geared their manufacturing procedure to, the latter will have to revise their procedure *if* they are to continue to use natural rubber in increasing amounts as they have been doing since the end of World War II.

With respect to synthetic rubbers, it is the writer's belief that all who are concerned with the production and marketing of crude natural rubber should bear in mind the fact that, although natural rubber at present has some characteristics and properties that make it superior to synthetic rubber for certain products, it is reasonable to expect that the producers of synthetic rubber are continually endeavoring to produce new types or change existing types so that they will have types comparable or superior to natural rubber for many uses. It has been the experience in the past that most new industries, as the volume of production increases, the cost per unit of production decreases, and this condition has been and generally may be expected to continue to be the case with synthetic rubber. Synthetic rubber, as now marketed, can be classed as an extremely uniform and clean product.

In the case of natural varnish resins, as compared with synthetic varnish resins, manufacturers of paints and varnishes found the synthetic product so superior in reliability and uniformity and priced so attractively that the trend in the use of the synthetic varnish resins has been definitely upward. A corresponding decline in the use of natural gums and resins has followed.

Perhaps if the price differentials between the higher and the lower grades of plantation rubber become stabilized at their present greater-than-prewar figure, it might be worth while for consuming factories to change compound formulae or do whatever else is necessary in order to use the lower grades. Possibly the quality of the finished products might still be maintained without the higher grades that had previously been thought to be essential.

It is not the writer's intention, however, to give an answer to all of these problems, but only to point out to those interested in the handling and the shipping of natural rubber, such as the underwriters and carriers, some of the reasons for the present increased rate of occurrence and amount of claims for loss and damage to rubber by importers and others concerned with the trade in rubber from the Far East.

# EDITORIALS

## Plantation Rubber Quality, Not Price, Must Be Improved

THE situation with respect to the steadily declining quality of plantation grades of natural rubber received in this country from the Far East, has developed to a point where it is inconceivable that corrective action can be delayed much longer. At the same time a leading figure in the plantation rubber industry, Sir John Hay, in a statement made in London in June, complains that consumers in the United States are opposed to buying "an essential raw material from an overseas territory and at a price necessary to give the producer a profit."

The government and the consuming industry in this country in formulating the recently enacted Rubber Act of 1948 were agreed that with the inadequate supplies of natural rubber estimated for the next two years, mandatory consumption of at least 225,000 long tons of synthetic rubber each year was necessary in order that a national security stockpile of natural rubber might be accumulated within that time. No isolationist philosophy in rubber can be detected in this position or in the policy declaration in the Act that "a free competitive synthetic rubber industry" in the United States be achieved as soon as "consistent with national security."

The American Government and the American consuming industry is not opposed to a price for natural rubber that will provide a reasonable profit for the producers, *but* that price must be for material of prewar quality, properly packaged and transported to this country so that on receipt the buyer gets what he paid for.

An article in this issue of India RUBBER WORLD, entitled "Postwar Packaging and Shipping of Plantation Rubber and Their Effect on Quality," provides concrete evidence that many natural rubber producers in the Far East are not supplying full value for the price being paid at the present time. This situation has been confirmed independently by the editor of India RUBBER WORLD with representatives of consuming factories.

The quality of plantation rubber from the Far East since the area was recovered following the late war has apparently gone in only one direction, *down*. Either this trend will have to be reversed, or the producers will most likely be faced with the possibility of obtaining an even lower price and an even smaller market in this country.

The war and the advent of the synthetic rubber industry in this country have accustomed the American consumer to clean, uniform raw material at a reasonable and stable price. He will still pay a higher price for clean, properly graded natural rubber, but the period during which he will continue to pay much more than the price of synthetic rubber for dirty, difficult-to-handle, poorly identified, and improperly graded natural rubber is about at an end.

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## Quality Control Techniques in Industry

IN CONTRAST to the bad situation described in the preceding editorial, the rubber goods manufacturing industry in the United States has become increasingly conscious of the necessity of improving and maintaining the quality of its products and, as a result, is adopting to a greater degree the techniques of quality control for its production and also for its development work.

Quality control techniques in production were introduced to a limited extent in the industry prior to the late war, but received much added impetus by virtue of their use in the synthetic rubber program during the war period and have been continued because of their demonstrated value. A symposium on rubber testing, held in connection with a meeting of the American Society for Testing Materials, in Atlantic City, N. J., in June 1947, and sponsored by Committee D-11, described the development of test methods and specifications for the synthetic rubber program and the standardization of production in the plants. These papers gave evidence of the very successful use of mathematical statistical methods in improving the precision of testing and the control of the quality of the end-product.

During the twelve months since June, 1947, the literature has included more papers on the use of statistical mathematical methods in quality control and development work, or the methods have been an essential part of the presentation and correlation of data obtained in experimental and development work in industry.

The A.S.T.M. has had for some time a separate committee, E-11 on Quality Control of Materials, which is comprised of the leading men in this field in the country. Committee E-11 acts only as an advisory committee to other industry committees in A.S.T.M. Because of the growing realization of the importance and value of statistical mathematical methods in the work of Committee D-11 on Rubber Products, this committee at its most recent meeting in Detroit, Mich., approved the establishment of a new subcommittee on statistical methods to work with the D-11 subcommittees in evaluating data obtained by these subcommittees in their work of formulating specifications and methods of test for the industry.

It is suggested that if there are companies in the rubber and associated industries that are not familiar with the use of statistical mathematical methods in industrial production and development work, it would be well for them to investigate the possible application of these methods as means of improving and maintaining their competitive position.

# DEPARTMENT OF
# PLASTICS TECHNOLOGY

## The Closed-Mold Method of Molding Thermosetting Materials[1]

C. A. Norris[2]

IN PRODUCING molded parts from thermosetting molding materials two basic methods are employed. In the first method the charge of molding material is placed directly into the mold cavity, and the heated mold is then closed under pressure on the material. In the second method the empty mold is first closed, and the material, in a plastic state, then forced from a pressure chamber into the cavities of the closed mold.

The term "compression molding" is used universally, both in this country and abroad, to describe the first method. But when it comes to the second method, a wide variety of descriptive terms is used. This closed mold method is referred to as transfer molding, extrusion molding, injection molding, plunger molding, jet molding, offset molding, high-speed molding, duplex molding, hyjector molding, and most likely by other terms in different geographic locations.

No attempt will be made here to differentiate or describe the differences that may exist between these modifications and refinements of the original closed-mold method of producing molded parts from thermosetting materials. It should be pointed out, however, that the use of the closed-mold principle is not new and has been employed for many years. It was originally looked upon as a specialized technique to be resorted to for the production of intricate pieces, particularly those requiring the use of delicate core pins or fragile inserts. In recent years a combination of circumstances has brought about a much broader use of this method of molding. Today it is estimated that a substantial percentage of phenolic molding material used in the United States is processed by the closed-mold method.

### Growth of Closed-Mold Method

Some of the factors that have been responsible for this expanded use of the closed-mold method are given below:

(1) The issuing of licenses to operate under patents assigned to the Shaw Insulator Co. This action made it possible for a number of molding companies to gain first-hand experience in this method of molding and thus become acquainted with its potentialities.

(2) The development of improved methods of preheating, particularly the introduction of the high-frequency method of preheating as applied to thermosetting materials. Prior to the development of high-frequency preheating it was extremely difficult, if not impossible, to preheat rapidly and uniformly a charge of molding material throughout its entire mass. High-frequency preheating eliminated this difficulty, and the tremendous resulting advantage can be appreciated by reviewing the record of some of the early work carried on under the direction of V. E. Meharg, of the Bakelite Corp.

One series of experiments was run on a production unit being used to make telephone handsets by this method of molding. The molding material specified for this job was of the improved impact-resistant type. This material was preformed and then preheated by a combination of hot plate and infrared lamps. The preheat time for this method varied between 3½ and four minutes, as compared with 45 to 50 seconds for high-frequency preheating. The time taken to force the material from the pressure chamber into the mold originally ran between 50 and 60 seconds. By thoroughly preheating the mold charge by means of a high-frequency oscillator this operation was performed in four to six seconds. The time consumed in curing the piece was reduced by an even greater extent. Here, cures originally requiring five to six minutes were completed in 30 to 45 seconds.

In Table 1 the optimum conditions have been selected for the original operation and compared with the least favorable values observed when high-frequency preheating was used. Even so, it can be seen that production was increased by more than 300% on this job by the use of high-frequency preheating.

TABLE 1. COMPARISON OF MOLDING CYCLES WITH STANDARD AND HIGH-FREQUENCY PREHEATING

| | Time Required for Operation, Seconds | |
|---|---|---|
| Operation | Original Practice | High-Frequency Preheat |
| Assemble mold | 45 | 45 |
| Close mold | 4 | 4 |
| Load chamber | 6 | 6 |
| Force material into mold | 50 | 6 |
| Cure | 300 | 45 |
| Open mold | 10 | 10 |
| Remove piece | 20 | 20 |
| Total time for cycle | 435 seconds (7 min., 15 sec.) | 136 seconds (2 min., 16 sec.) |

It has been found by experience that most of the beneficial effect of high-frequency preheating is lost if too long a period of time is allowed to elapse before getting the preheated mold charge under pressure in the mold. In large multiple-cavity compression molds it is very difficult to load the many cavities with sufficient speed to take full advantage of the thoroughly preheated mold charge. Such is not the case with a closed-mold operation. Here, there is generally only one cavity or pressure chamber to load, and this operation can be done very rapidly. This fact has unquestionably had a very decided influence on the expanded use of the closed-mold method of molding.

(3) The demand during the last war to produce necessary plastic components at top production levels also influenced the expansion of the closed-mold method. The M52 fuses and the telephone handsets were two of these war jobs which provided a tremendous fund of fundamental knowledge. They demonstrated beyond question that with basic understanding and proper control the closed-mold method is mechanically practical and economically sound.

(4) Another influential factor was the modernization and application of the opposing ram press to the closed-mold method, such as the work undertaken at Bryant Electric Co. under the supervision of C. J. Smith. Much of the experience thus gained has been made available to the industry.

These four factors, coupled with the ever-existing urge so characteristic of our competitive system to find ways and means of lowering production costs, have been mainly responsible for the expanded use of the closed mold method of molding over the past few years.

### Fundamental Principles

In a study of the closed-mold process made by E. W. Vaill, of Bakelite Corp., he points out that certain fundamental principles must be observed if maximum efficiency is to be obtained The five main fundamentals are listed by him as follows:

(1) Mold design — proper design of cavities, runners, gates, and vents are of paramount importance.

(2) Selection of material — the plastic characteristics and the behaviorism of the material must be carefully considered.

(3) Molding pressures — proper relation between injection pressure and mold clamping pressure is of primary importance.

(4) Mold and preform temperatures — careful control of optimum high-frequency preheating and the maintenance of uniform mold temperatures must be established.

(5) Preform size and pressure chamber dimensions — pressure chamber must be of adequate size to accommodate readily the charge of molding material.

An analysis of each of these five fundamental principles follows:

### Mold Design

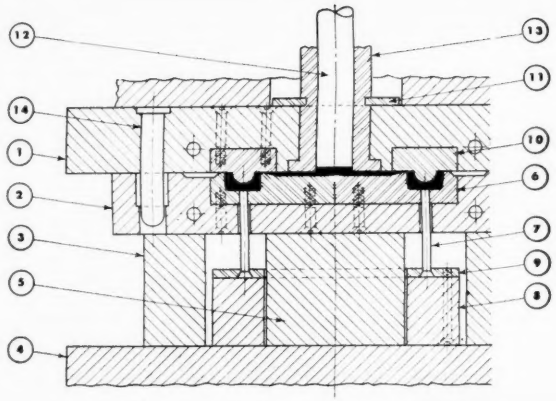
Experience with different types of presses and mold designs indicates the following to be good practice for general mold design. Individual hardened steel cavities should be mounted in the chase plate which should be cored for steam heating. The cavity and chase plate land areas should be ground and polished to insure maximum surface contact when the mold is closed. This condition prevents flashing of the material from the cavities and runners (see Figure 1).

KNOCKOUT. It is advisable to have the knockout pins on that half of the mold opposite the pressure chamber. Therefore the location of the cavity in either the top or the bottom plate is dependent upon whether the piece will be ejected from the cavity or the force plug.

BOLSTER PLATES AND PARALLELS. It is essential that the mold be adequately supported directly under the pressure chamber to insure against distortion or sagging of

[1] Presented before annual conference, Pacific Coast Section, Society of the Plastics Industry, Inc., Santa Barbara, Calif., Mar. 29, 1948.

[2] Assistant general sales manager, Bakelite Corp., New York, N. Y.




1. Cross-Sectional View of Mold Design to Prevent Flashing of Molding Material

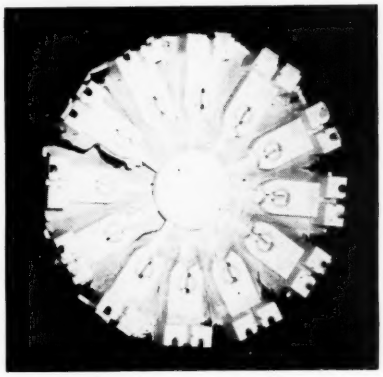
| | |
|---|---|
| 1—Pot Retainer | 8—Knockout Bar |
| 2—Retainer | 9—Knockout-Pin Plate |
| 3—Parallel | 10—Force |
| 4—Mounting Plate | 11—Clevis Plate |
| 5—Support Pillar | 12—Pot Plunger |
| 6—Cavity | 13—Pot |
| 7—Knockout Pin | 14—Leader Pin |

the mold at this point when pressure is applied. If this precaution is not taken, mold flashing will result and cause non-uniform filling of the cavities (see Figure 2). Bolsters may be either of the ring or bar type, but must be of the correct height and of sturdy construction.

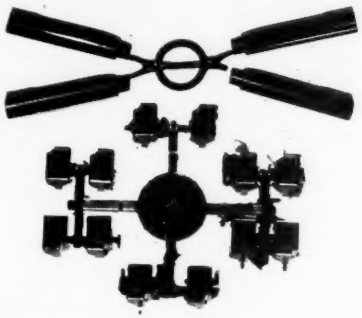
Chrome Plating of Mold. Chrome plating the cavities and force plugs has been found advantageous In addition to providing a hard wear-resistant surface, it also simplifies the removal of the parts from the mold. The chrome plating operation should be postponed until the mold has been put into service and all necessary adjustments have been completed. Gates and vents may require enlarging. Small undercuts at strategic locations may be desirable for holding the piece in the predetermined half of the mold where the knockout pins are located. All such changes should be made before the mold is chrome plated.

Position of Cavities. It is generally advantageous to place the cavities in a circular position around the pressure chamber (see Figure 3). This construction makes possible the use of a radial runner of the shortest length. The individual short radial runner to each cavity insures filling under maximum pressure, but this arrangement does have the disadvantage of limiting the number of cavities per mold and may also complicate the knockout bar construction. While desirable, the radial runner design is not mandatory. Molds with cavities in line using the multiple "T" design runner have been found to give very satisfactory results and make possible the inclusion of more cavities in the mold. Runners of the radial "Y" design are also frequently used (see Figure 4). This "Y" design might be considered somewhat of a compromise between the circular and multiple "T" designs.

Position of Gates. There are two schools of thought, diametrically opposed to each other, regarding the proper location of gates. One group recommends that the gate to the cavity should be placed at the smallest or lightest end of the piece. The other is just as emphatic that for best results the part should be gated at its heaviest section. Concrete examples of successful results are cited by each in substantiation of their contention. This fact brings one to the conclusion that there is no hard and fast rule that can be set



2. Flashing and Non-Uniform Filling of Mold Cavities Resulting from Inadequate Support of Mold Directly under Pressure Chamber

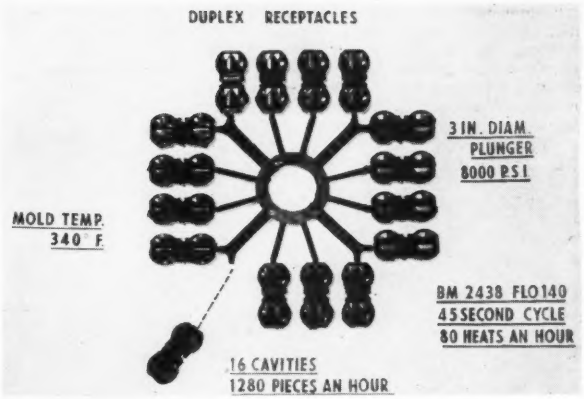


4. Products Molded by Other Than Radial Runner Design: *(Bottom)* Multiple "T" Design Runners; *(Top)* Radial "Y" Design Runners

forth covering all conditions. The proper location of the gate is dependent for the most part upon the size and the shape of the part in question. Experience indicates, however, that it is good practice to place the gate at a heavy section.

Care should be taken not to gate the cavity directly opposite a mold pin or other protrusion in the mold. Gating at such a point will cause the stream of material entering the cavity to change its direction of flow and divide into two or more streams This result is liable to cause weld marks and knit-lines and impair the physical strength of the molded piece.

If practical, the gate should be placed on a surface easily accessible so that its removal may be accomplished by a simple




3. Electrical Plug Receptacles Molded with Circular Cavities and Radial Runners

finishing operation.

Gate Size. The size of the cavity gate is of major importance and is dependent upon such factors as the type of material to be used, size and shape of the part, as well as the magnitude of pressure exerted on the plastic material. Gates for comparatively small pieces using general-purpose wood flour-filled phenolic materials should be 0.100-inch wide and 0.015-inch deep. Some adjustment may be found necessary to bring about uniform filling of all cavities, but, as a starting point at least, these dimensions have been found satisfactory. When mineral-filled phenolic materials are to be used, it is advisable to use somewhat larger gates. A width of 0.125-inch and a depth of 0.030-inch is generally adequate, but again some alterations are quite likely to be found necessary.

Fabric-filled phenolic impact materials also require the use of enlarged gates. Under certain conditions gates as large as 0.500-inch wide and 0.125-inch deep have been found necessary to prevent disintegration of the filler as it passes through the gate into the mold cavity.

When fabric-filled materials are used, caution should be exercised in evaluating the shock-resistant properties of the molded part produced by this method. Satisfactory results are possible with the right combination of gate size, pressure, and temperature, but it is essential that the size of the gate be sufficiently large so that the filler is not broken down as it is forced through the orifice.

Design of Runners. Hardened steel blocks containing the runners should be inserted in the chase plate. The center block at the bottom of the pressure chamber should also be a hardened steel insert. By the use of independent hardened steel blocks for the runners and the pressure chamber it is possible to obtain longer life from the mold. When the runners have become worn by abrasion of the material, they may be readily replaced. Runners should always be incorporated in the same half of the mold as the knock-out pins, in other words, on the same side of the mold from which the parts are to be ejected. Main runners should be 1/4- to 5/16-inch wide and 1/8-inch deep. It is also wise to provide a 1/8-inch radius at the bottom of the runner. Branch runners should be approximately 1/8-inch wide and 3/32-inch deep. It has been found good practice to keep the length of the runners as short as practical. Each runner should extend into the bottom of the pressure chamber at least one-half inch and preferably run completely across the

bottom and join with the runner diametrically opposite.

VENT DESIGN. The importance of vents should not be underestimated. Very frequently they are found to be essential in order that air and gases may be expelled from the cavity as the material fills the mold. Vents should be located on the same half of the mold as the runners at the point which fills out last. This point is generally farthest from the gate. Vents 0.005-inch deep and 1/16- to 1/8-inch wide extending to the edge of the mold plate generally prove adequate.

PRESSURE CHAMBER AND PLUNGER DESIGN. The diameter and the depth of the pressure chamber are dependent upon the volume of material used in each charge and the total clamping pressure of the press. The method of determining the pressure chamber depth and diameter together with the resulting plunger pressure will be discussed later. The pressure chamber well should consist of a hardened steel bushing or sleeve having a wall thickness of not less than ¾-inch. The length of this sleeve should be equal to the depth of the pressure chamber.

The plunger attached to the end of the injection ram is also made of hardened steel. A clearance of 0.003- to 0.005-inch is provided between the plunger and the pressure chamber sleeve; in other words, the difference between the inside diameter of the plunger is 0.006- to 0.010-inch. The plunger is sometimes provided with a seal groove around it to prevent flashing, but this is usually found unnecessary. Under certain circumstances it is advantageous to heat the plunger either electrically or with steam. In most cases this heating is unnecessary since the plunger picks up sufficient heat from the preheated mold charge and the heated portions of the mold proper.

#### Selection of Material

In selecting a thermosetting material for the closed-mold method of molding, its behaviorism, when subjected to heat and pressure, must be considered. Properties such as flow, set-time, thermal conductivity, and dielectric characteristics also determine whether or not the performance of the material will be satisfactory.

The choice of the proper plasticity to be used on a particular job is of major importance. If the material is too soft, an extended preheating time will be required to achieve minimum time in curing. A free-flowing material is also liable to cause mold flashing even when the computation of areas and pressures indicates that the clamping pressure should be adequate.

Experience indicates that there is a minimum flow at which a material can be satisfactorily used for a given set of operating conditions. Below this minimum flow the material lacks sufficient mobility to fill out the mold completely. However it has been found that materials over a fairly wide range of flows can be satisfactorily employed if proper attention is given to choice of preheat time and molding pressure.

Phenolic molding materials of the wood flour-filled type, in flows of 100 to 140, have proved quite satisfactory when mold temperatures of 325 to 345° F. are used.

The "set times" or speed of cure should be somewhat slower than is found in some of the extremely fast-curing compression molding materials on the market today. The ideal molding material would soften rapidly when subjected to heat and pressure without, at any time, becoming very fluid. It would stay in this soft condition long enough to fill the mold completely and then set and harden in a minimum period of time.

#### Molding Pressures

In the closed-mold method of producing molded parts it is extremely important that the total clamping pressure holding the mold closed is always greater than the pressure exerted within the cavities and runners acting to force the mold open. Each molding job should be carefully analyzed and pressures calculated to make sure this condition exists, allowing an added 15% safety factor to insure adequate clamping action.

In making these calculations five different pressures are encountered. While they are interrelated, they should not be confused with each other. They are as follows:

*Line pressure* is the pressure exerted in the supply line of the hydraulic system by means of a pump or accumulator. The figure is expressed in pounds per square inch (p.s.i.).

*Clamping ram pressure* is the force delivered by the injection ram, and is expressed in pounds or tons. It is determined by multiplying the area of the ram by the line pressure.

*Injection ram pressure* is the force delivered by the injection ram, and is expressed in pounds or tons. It is determined by multiplying the area of the ram by the line pressure.

*Plunger pressure* is the pressure exerted on the material in the pressure chamber by the plunger. It is determined by dividing the injection ram pressure by the area of the plunger. It is expressed in pounds per square inch (p.s.i.).

*Mold clamping pressure* is the effective pressure acting to hold the mold closed against the pressure exerted within the cavities and runners. It is expressed in pounds per square inch (p.s.i.) and is determined by dividing the clamping ram pressure (pounds) by the total horizontal cross-sectional area (square inches) of the cavities and runners.

These different pressures may be expressed as follows:

Let L = line pressure (p.s.i.)
Am = area of mold cavities and runners (sq. in.)
Ar = area of clamping ram (sq. in.)
Ai = area of injection ram (sq. in.)
Ap = area of plunger (sq. in.)
Then CRP or clamping ram pressure = Ar x L (lbs. or tons)
IRP or injection ram pressure = Ai x L (lbs. or tons)

$$\text{PP or plunger pressure} = \frac{\text{Ai} \times \text{L}}{\text{Ap}} \text{ (p.s.i.)}$$

$$\text{MCP or mold clamping pressure} = \frac{\text{Ar} \times \text{L}}{\text{Am}} \text{ (p.s.i.)}$$

The practical application of these expressions is demonstrated in the following examples:

*Example A:*

How many cavities can be built into a mold where the following conditions exist:
Horizontal cross-sectional area of the part to be molded = 3 sq. in.
Estimated area of runner per cavity = 1 sq. in.
Total area per cavity (cavity plus runner) = 4 sq. in.
Hydraulic press with 14-inch clamping ram and a 6-inch top cylinder injection ram is used. Line pressure = 2,000 p.s.i. Pressure chamber plungers are 3 inches in diameter.
X = the number of cavities
L = line pressure of 2,000 p.s.i.
Am = 4X
Ar = 154 sq. in. (for 14-inch diameter clamping ram)
Ai = 28.3 sq. in. (for 6-inch diameter injection ram)
Ap = 7 sq. in. (for 3-inch diameter plunger)
CRP = Ar x L = 154 x 2,000 = 308,000 lbs.
IRP = Ai x L = 28.3 x 2,000 = 56,000 lbs.

$$\text{PP} = \frac{\text{Ai} \times \text{L}}{\text{Ap}} = \frac{56{,}000}{7} = 8{,}085 \text{ p.s.i.}$$

$$\text{MCP} = \frac{\text{Ar} \times \text{L}}{\text{Am}} = \frac{308{,}000}{4\text{X}} = \frac{77{,}000}{\text{X}} \text{ p.s.i.}$$

If the pressure holding the mold closed (MCP) just equalled the pressure acting to force the mold open (PP), then MCP = PP. For safe operating conditions a 15% factor of safety should be provided so that the mold will not flash. Therefore:

$$\text{MCP} = 1.15 \times \text{PP}$$

$$\frac{77{,}000}{\text{X}} = 1.15 \times 8{,}085$$

$$\text{X} = \frac{77{,}000}{1.15 \times 8{,}085} = \frac{77{,}000}{9{,}197.75} = 8.3 \text{ or } 8 \text{ cavities.}$$

*Example B:*

Why does a mold flash badly under the following conditions:
The mold has 12 cavities each of 1¾ sq. in. cross-section.
The runner area for each cavity is estimated as being ½ sq. in.
The press has a main clamping ram 14 inches in diameter.
The injection ram is 6 inches in diameter.
The plunger ram is 2½ inches in diameter.
The line pressure is 2,000 p.s.i.

To solve: L = 2,000 p.s.i.
Am = 12 x (1¾ + ½) = 12 x 2.25 = 27 sq. in.
Ar = 154 sq. in.
Ai = 28.3 sq. in.
Ap = 5 sq. in.
CRP = 154 x 2,000 = 308,000 lbs.
IRP = 28.3 x 2,000 = 56,000 lbs.

$$\text{PP} = \frac{56{,}600}{5} = 11{,}320 \text{ p.s.i.}$$

$$\text{MCP} = \frac{308{,}000}{27} = 11{,}040 \text{ p.s.i.}$$

As the plunger pressure of 11,320 p.s.i. is greater than the mold clamping pressure of 11,040 p.s.i., it is obvious that the mold will be forced open, allowing the material to be flashed out without completely filling the cavities.

To correct the condition either the plunger pressure should be decreased or the mold clamping pressure increased. If the first method is chosen, to what pressure should the injection ram line pressure be reduced?
Let L′ = reduced line pressure to injection ram
P′P′ = new plunger pressure
Then 1.15 P′P′ = MCP

$$\text{P′P′} = \frac{\text{MCP}}{1.15} = \frac{11{,}040}{1.15} = 9{,}600 \text{ p.s.i.}$$

$$\text{P′P′} = \frac{\text{Ai} \times \text{L′}}{\text{Ap}}$$

$$9{,}600 = \frac{28.3 \times \text{L′}}{5}$$

$$\text{L′} = \frac{9{,}600 \times 5}{28.3} = \frac{48{,}000}{28.3} = 1{,}700 \text{ p.s.i.}$$

This would seem to be the simplest solution. However, should the mold be moved to a press of greater capacity, how large should the clamping ram be?
Let Ar′ = area of the required ram
Then 1.15 PP = MCP, when PP = 11,320 p.s.i

$$\text{and MCP} = \frac{\text{Ar′} \times \text{L}}{\text{Am}}$$

$$1.15 \times 11{,}320 = \frac{\text{Ar′} \times 2{,}000}{27}$$

$$\text{Ar′} = \frac{27 \times 1.15 \times 11{,}320}{2{,}000} = 176 \text{ sq. in.}$$

A ram 15 inches in diameter has an area of 176.7 sq. in., which would be satisfactory.

Mold flashing may also be caused by misalinement or distortion of the plates owing to lack of sufficient bolstering of the mold under the pressure chamber.

#### Mold and Preform Temperatures

The optimum degree of high-frequency preheat should be established and then carefully maintained together with uniform control of mold temperature to insure uniformity of product and minimum number of rejects. Preforms should be heated until soft and spongy and then placed into the pressure chamber as quickly as possible in order to take full advantage of the preheating operation.

The length of preheat time will vary according to the size of the mold charge,

TABLE 2. "PLUNGER MOLD PRESSURE AND PREFORM RATIO CHART"

| *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* |
|---|---|---|---|---|---|---|---|
| Plunger | | Plunger Pressure, tons | | Preform Size and Weight* | | | |
| Diameter, Inches | Area Sq. In. | For 8,000 P. S. I. | For 12,000 P. S. I. | Maximum Diameter,† Inches | Maximum Height,‡ Inches | Volume,§ Cu. In. | Weight,¶ Gms. |
| 1.500 | 1.767 | 7.1 | 10.6 | 1.312 | 3.43 | 4.62 | 86 |
| 1.562 | 1.918 | 7.7 | 11.5 | 1.375 | 3.50 | 5.20 | 96 |
| 1.625 | 2.074 | 8.3 | 12.4 | 1.500 | 3.75 | 6.64 | 123 |
| 1.687 | 2.246 | 9.0 | 13.5 | 1.500 | 3.75 | 6.64 | 123 |
| 1.750 | 2.405 | 9.6 | 14.5 | 1.562 | 3.93 | 7.52 | 140 |
| 1.812 | 2.580 | 10.3 | 15.5 | 1.625 | 4.06 | 8.42 | 156 |
| 1.875 | 2.761 | 11.0 | 16.5 | 1.687 | 4.25 | 9.50 | 178 |
| 1.937 | 2.948 | 11.8 | 17.6 | 1.750 | 4.37 | 10.50 | 194 |
| 2.000 | 3.141 | 12.6 | 19.0 | 1.812 | 4.50 | 11.60 | 214 |
| 2.062 | 3.341 | 13.3 | 20.0 | 1.875 | 4.68 | 12.90 | 238 |
| 2.125 | 3.546 | 14.2 | 21.2 | 1.937 | 4.87 | 14.37 | 266 |
| 2.187 | 3.758 | 15.0 | 22.6 | 1.937 | 4.93 | 14.50 | 268 |
| 2.250 | 3.976 | 16.0 | 24.0 | 2.000 | 5.00 | 15.70 | 290 |
| 2.312 | 4.200 | 16.7 | 25.2 | 2.062 | 5.15 | 17.3 | 320 |
| 2.375 | 4.430 | 17.7 | 26.6 | 2.125 | 5.30 | 18.8 | 350 |
| 2.437 | 4.666 | 18.7 | 28.0 | 2.187 | 5.50 | 20.6 | 380 |
| 2.500 | 4.908 | 19.7 | 26.9 | 2.250 | 5.62 | 22.3 | 412 |
| 2.562 | 5.157 | 20.6 | 31.0 | 2.250 | 5.62 | 22.3 | 412 |
| 2.625 | 5.412 | 21.6 | 32.5 | 2.375 | 5.87 | 26.0 | 480 |
| 2.687 | 5.673 | 22.7 | 34.0 | 2.437 | 6.12 | 28.5 | 527 |
| 2.750 | 5.940 | 23.8 | 35.7 | 2.500 | 6.25 | 30.6 | 566 |
| 2.812 | 6.213 | 25.0 | 37.3 | 2.500 | 6.25 | 30.6 | 566 |
| 2.875 | 6.492 | 26.0 | 39.0 | 2.625 | 6.56 | 35.5 | 656 |
| 2.937 | 6.777 | 27.0 | 40.6 | 2.625 | 6.56 | 35.5 | 656 |
| 3.000 | 7.068 | 28.2 | 42.4 | 2.750 | 6.87 | 40.8 | 755 |
| 3.250 | 8.296 | 33.2 | 50.0 | 2.937 | 7.31 | 49.5 | 915 |
| 3.500 | 9.621 | 38.5 | 58.0 | 3.125 | 7.75 | 59.5 | 1100 |
| 3.750 | 11.045 | 44.4 | 66.5 | 3.375 | 8.31 | 71.4 | 1320 |
| 4.000 | 12.566 | 50.3 | 75.5 | 3.625 | 9.06 | 93.7 | 1735 |
| 4.250 | 14.186 | 57.0 | 85.0 | 3.875 | 9.62 | 114.5 | 2120 |
| 4.500 | 15.904 | 63.6 | 95.5 | 4.000 | 10.00 | 125.6 | 2320 |
| 4.750 | 17.721 | 71.0 | 106.5 | 4.250 | 10.62 | 150.0 | 2780 |
| 5.000 | 19.635 | 78.5 | 117.5 | 4.500 | 11.25 | 178.0 | 3300 |

*For cellulose-filled phenolic materials having a molded specific gravity of 1.40 and a preform density of 18.5 grams per cubic inch.
†Maximum diameter of preforms is 10% less than plunger well diameter in 1/16 inch increments.
‡Maximum height of mold charge (stacked preforms) is 2½ times the preform diameter.
§Total cubic-inch volume of mold charge.
¶Total gram weight of charge (equals 18.5 x volume).

capacity output of the high-frequency oscillator, and the type of material being used. In general, a charge of wood flour-filled phenolic material weighing about 250 grams can be brought up to 270° F. in 30 seconds when preheated in a high-frequency unit having an output of two kilowatts.

The preheat time should run concurrently with the cure so that there will be no loss of operating time over the complete cycle. It is good practice automatically to control the time of preheat rather than leave it to the discretion of the operator. Comparatively small variations in the length of preheat time will cause wide differences in the degree of softness of the preforms, thus affecting the plastic behavior of the material. Mold temperatures of 325-340° F. should be maintained.

#### Preform Size and Pressure Chamber Dimensions

Table 2, the "Plunger Pressure and Preform Ratio Chart" prepared by D. M. Buchanan, of Bakelite, is very helpful in determining the diameter of preform and pressure chamber depth to be used with wood flour-filled materials. Before examining the table in detail it might be well first to review the following fundamental requirements:

(a) Sufficient space should be provided between the upper half of the mold and the head of the press in order that the preheated preforms may easily and quickly be loaded into the pressure chamber.

(b) The diameter of the preforms should be at least 10% less than the inside diameter of the pressure chamber to allow for swelling of the preform during the preheating operation. For rapid loading the preform must drop freely into the pressure chamber.

(c) The total height of the preform charge should not be more than 2½ times the preform diameter (see Table 2, columns F and G).

(d) The mold charge should be sufficiently large so that the cull of material left at the bottom of the pressure chamber is not less than 1/16-inch thick. Lesser quantities are liable to produce parts of low density owing to lack of positive pressure on the material entering the cavities at the end of the stroke.

(e) It is important that the plunger enter the pressure chamber for a distance of at least 3/8- to 1/2-inch before coming into contact with the mold charge of material. If this precaution is not taken, the soft material will in all probability flash out of the pressure chamber when struck by the fast-moving plunger. This loss of material will result in "short" or low density molded parts.

The use of data given in Table 2 can perhaps be best illustrated by means of the following examples:

*Example C:*

What size preform and pressure chamber should be used for a mold charge of ½-pound or 227 grams?

Read down column *I* to 238 grams (nearest value to 227 grams), then read across. In column *H* the volume of the preform charge is given as 12.9 cu. in. The maximum height of the charge is shown in column *G* as being 4.68 inches. This indicates that a pressure chamber depth of five inches should be adequate. In column *F* the maximum diameter of the preform is given as 1.875 inches. A 13.3-ton capacity top ram should be used for a two-plunger pressure of 8,000 p.s.i., according to column *D*. The diameter of the plunger is found in column B as being 2 1/16 inches.

*Example D:*

The table may also be used to determine the maximum mold charge possible for a given set of conditions, such as those used in the previous *Example A*.

Given: Plunger diameter = 3 inches
Number of cavities = 8
From the table: Maximum preform diameter = 2.75 in.
Height of mold charge = 6.87 in.
Volume of preform charge = 40.8 cu. in.
Total weight of charge = 755 grams maximum

Allowing 10% for cull and runners, this leaves 680 grams for the eight cavities, or 85 grams for the maximum possible weight of each molded piece.

#### Summary and Conclusions

The closed-mold method of producing parts from thermosetting materials has been found to have both mechanical and economic advantages. It is hoped that this paper, outlining some of the theoretical aspects and their practical application, will be helpful, particularly to the uninitiated in becoming better acquainted with this method of molding.

By recognizing and taking full advantage of such developments as high-frequency preheating, coupled with the closed-mold method of molding, the plastics industry will continue to play an ever-increasing important part in the economic and industrial advancement so important to the United States and to the world.

## New SPI Members

WILLIAM T. CRUSE, executive vice president of the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y., has announced that eight companies were elected to membership in the SPI by the board of directors at its meeting on June 10 and 11 at the Sheraton Hotel, Rochester, N. Y. Of these new members, seven companies are located in the United States and one in Victoria, Australia. International in scope with more than 500 company members in the United States and 14 foreign countries, the SPI is established to assist and further the interests of the plastics industry through technical, trade, and consumer channels.

The new members are: Deco-Plastics, Inc., Louisville, Ky., fabricator; M. W. Kellogg Co., Jersey City, N. J., material manufacturer; Kopplin Molding Corp., St. Louis, Mo., molder; Polymer Corp., Reading, Pa., manufacturer of nylon rods and strips; Ross & Roberts, Inc., West Haven, Conn., film calenderer; United States Testing Co., Inc., Hoboken, N. J., testing laboratory; Wolverine Plastics, Inc., Milan, Mich., injection molder; and Moulded Products, Ltd., Victoria, Australia, molder, extruder, and processor of vinyl film.

## Two-Color Tapes and Shapes

A NEW technical achievement in the extrusion of Elastron compounds in multi-color tapes and shapes has been announced by Industrial Synthetics Corp., Garwood, N. J. While extrusion of multicolors adjacent to one another has been done in the past, the company believes that it is the first to extrude a solid color on one side and different solid color on the opposite side of a tape or shape.

At present the company is producing a two-color tape in three-quarter and one-inch widths in a large variety of color combinations, including black and white, brown and green, red and royal blue, and many others. According to Sales Manager M. Robert Lustgarten, the two-color extrusion has gained ready acceptance as a novel material which has limitless possibilities.

# Basic Concepts in the Selection of Plasticizers for Polyvinyl Chloride[1]

Robert J. Myers[2]

THE compounder and the processor of polyvinyl chloride plastics have a real interest in the plasticizer component of the plastic mix inasmuch as it is the character of the plasticizer that determines to a large extent the properties of the finished article. The selection of a plasticizer by the compounder is based upon the qualities that it imparts to the final product, as well as those properties it exhibits during the compounding and the finishing operations. The formulation of a commercial plastic product with desirable qualities is indeed an art, but certain basic principles may be derived from an analysis of performance in terms of the fundamental characteristics of the plasticizer, and these principles are of value in guiding the enterprising compounder. It is the object of this paper to consider those basic qualities of plasticizers which are of importance to the manufacturer of polyvinyl chloride plastics, as well as to the manufacturer of plasticizers.

### Definitions

The basic concept of the function of a plasticizer is well known. We need only remind ourselves that the plasticizer molecule, by virtue of its chemical composition, exerts a solvating attraction for the polyvinyl chloride such that the strong polymer-to-polymer attractive forces are overcome, and the long polymer chains are freed to assume more or less spring-like helical structures capable of responding to external stresses by elongation and contraction. It is probable that some such mechanism is responsible for the transformation of rigid polyvinyl chloride into an elastic substance.

Plasticizers for polyvinyl chloride or other materials are classified conveniently into "primary" and "secondary" plasticizers. A primary plasticizer would be defined as a material that is compatible with polyvinyl chloride in all useful proportions and is sufficiently permanent to yield a composition that will retain the desired properties over its useful life period. Secondary plasticizers are defined as materials having limited compatibility with polyvinyl chloride that are employed in addition to primary plasticizers to produce certain desired effects in the final stock.

### Types of Plasticizers

Plasticizers, both primary and secondary, of a variety of types have been used in polyvinyl chloride compositions since the very first production of these plastics. The plasticizers employed at first were highly efficient materials, but many of these plasticizers were soon abandoned since it was found that they volatilized from the plastic over long periods of time, causing the plastic to become unserviceable. The resulting emphasis on plasticizers possessing greater permanence and stability led to the adoption of materials such as diethyl hexyl phthalate, dicapryl phthalate, di-ethyl hexyl sebacate, tricresyl phosphate, and butyl phthalyl butyl glycollate, and these are widely used today.

During the war years the demand for a non-volatile, non-migrating plasticizer for polyvinyl chloride sheaths for high-frequency electric cable fostered the development and the adoption of the new resinous plasticizer, Paraplex G-25, for this application. The resinous plasticizers opened a new chapter in the compounding of polyvinyl chloride plastics, and the subsequent development of Paraplex G-40 and Paraplex G-50 further enlarged the range of usefulness of the resinous-type materials.

The immediate postwar expansion of the use of polyvinyl chloride saw the influx of low quality plasticizers, but the gradual return to a buyer's market has brought with it an emphasis on quality performance. It is pertinent, therefore, to inquire into those qualities of plasticizers which will satisfy the demand for superior performance in polyvinyl chloride plastics.

### Plasticizer Requirements

We may consider first a tabulation of those properties which may be termed "desirable" in a plasticizer for polyvinyl chloride. These properties are given in Table 1:

TABLE 1. DESIRABLE PROPERTIES OF A POLYVINYL CHLORIDE PLASTICIZER

I. Permanence. Includes:
  (a) complete compatibility over the useful range of concentrations
  (b) negligible volatility
  (c) minimum of migration
  (d) high resistance to extraction by oil and water.
II. Stability. Includes:
  (a) heat stability:
    (1) not a catalyst for the breakdown of polyvinyl chloride
    (2) resistance to effect of hydrogen chloride liberated by polyvinyl chloride breakdown
  (b) ultra-violet light stability
III. No objectionable odor.
IV. Properties of variable importance, including:
  (a) good low-temperature flexibility or drape
  (b) good electrical properties
  (c) color
  (d) flame resistance
  (e) non-toxicity

It is improbable that any single plasticizer will be developed which will possess all of the above desirable properties. Certainly no plasticizer available today answers all of these requirements. The combination of plasticizers to produce a polyvinyl chloride plastic having commercial value is the basis of the compounder's art. We can hope to aid him in this task by an analysis of the factors which contribute to the satisfaction of each requirement and by pointing out the type of plasticizer which should be selected to obtain any single requirement in the final compound.

### Analysis of Requirements

#### Compatibility

Compatibility of a material with polyvinyl chloride is achieved through certain polar groups that exert a solvating effect on the polymer. The ester, keto, nitrile, amide, phosphate, and aryl groups are the most commonly used means for affecting the compatibility of a molecule with the resin.

The ester group exerts a fairly strong solvating effect on the polymer and has, in general, fairly good all-around properties, with the possible exception of a tendency to hydrolyze in the presence of acids and bases. The keto group exerts a fair solvating effect, but the poor ultra-violet light stability of this group is a distinct disadvantage at times. The amide and nitrile groups exert a very strong solvating effect on the polymer, and the latter shows good stability. The amide group appears to contribute to the instability of the polyvinyl chloride and is now rarely used. The phosphate group is generally employed to impart flame resistance. The aryl group, or aromatic ring, is often introduced into the polymer to aid electrical properties, but this is often accompanied by a sacrifice in low-temperature properties.

In summary, the ester and nitrile groups offer a good approach to the problem of compatibility, and it is no accident that the most valuable plasticizers today contain one or the other of these groups.

#### Volatility

The tendency of a plasticizer to volatilize from a film of plasticized polyvinyl chloride is related to its vapor pressure, which in turn is controlled to a large extent by the molecular weight. While it is true that the failure of a polyvinyl chloride film after long exposure is more often due to other factors than volatility, and that the actual evaporation of a substance, such as dicapryl phthalate, from a film over a long period of time can be shown to be quite negligible, still the safest approach to the selection of a permanent plasticizer will be based on a search for a compound of high molecular weight, other factors being equal.

#### Migration

The migration of a plasticizer from a polyvinyl chloride plastic composition into the supporting structure, or into adjacent polymeric systems such as lacquers, varnishes, or other resins, is a complex phenomenon and at times difficult to analyze in terms of the variables involved. In general, however, it is obvious that the rate of diffusion of the plasticizer out of the plastic and into adjacent structures is the governing factor, and that compounds of very high molecular weight, such as the resinous plasticizers, will show very low diffusion rates. It is thus possible to use a resinous plasticizer, which is in itself a solvating plasticizer for the adjacent structure, as the plasticizer in a polyvinyl chloride composition, and no migration of the plasticizer is observed.

#### Resistance to Extraction

The same controlling factor as in migration: namely, the rate of diffusion, is operative in the extraction of a plasticizer from a polyvinyl chloride film by oil or water. Again, the selection of a high molecular weight derivative is dictated to avoid the loss of plasticizer, if other factors are equal.

#### Stability to Heat and Light

The stability of a polyvinyl chloride compound to heat and light is as often determined by the specific combination of plasticizers, fillers, and stabilizers used as by the resistances of the individual components to heat and light. It is extremely difficult to predict the performance of the compounded system on the basis of knowledge of the behavior of the single components. Nevertheless the use of plasticizers which show good heat and light stability, when employed in simple systems, is indi-

[1] Presented before the Boston Rubber Group, Boston, Mass., Mar. 19, 1948.

[2] Head of miscellaneous resin applications laboratory, The Resinous Products & Chemical Co., Washington Sq., Philadelphia 5, Pa.

cated in the formulation of a complex mixture. The polyester type of plasticizer merits serious consideration in this respect.

#### Odor

The odor of a plasticizer should certainly be pleasant, if any odor at all does exist. Here again the vapor pressure of the compound can be used as a rough guide, and consideration of high molecular weight compounds is indicated to avoid difficulties during compounding at elevated temperatures and in service of thin films.

#### Low-Temperature Flexibility

Flexibility and drape at low temperatures are usually achieved in practice by the balanced compounding of plasticizers. Those derivatives that contribute to low-temperature drape, but are also subject to extraction and migration, must be balanced by plasticizers of a more permanent character. Fundamental studies on present plasticizers have shown that the low-temperature flexibility of plasticized polyvinyl chloride compositions is closely related to the oil extractability of plasticizer used.

We are in essence trying to "eat our cake and have it too" in our efforts to build in low-temperature flexibility together with non-extractability and non-migration. This problem, however, presents a challenge to the organic chemist, and we are hopeful that the future will see the development of high molecular weight compounds that also exhibit good low-temperature properties. In the meantime much can be done by the compounder who recognizes the fundamental factors involved.

#### Electrical Properties

In common with low-temperature flexibility, the electrical properties of a polyvinyl chloride compound come into consideration mainly in specialty compositions. The purity of the plasticizer is of great importance in electrical applications, and the design of a plasticizer for such application is more often than not a specific job for the plasticizer manufacturer. The recent trend toward extreme permanence in polyvinyl chloride wire insulation compounds has focused attention on the high molecular weight derivatives, and the purity of certain of these materials is already satisfactory for some usages.

#### Color

The color factor is of prime importance in clear free film, and of lesser importance in pigmented stocks. Color is often associated with the purity of the plasticizer, and the customary approach to better color is through distillation. The very low vapor-pressure characteristics of the permanent plasticizers impose a problem in distillation, and it is not surprising that distillation or other processes employed for color removal may add materially to the price of the product. The improvement in color must, moreover, be permanent and not subject to change during processing or during the useful life of the plasticized compound. The wide use of plasticizers of moderate color is a tribute to compounders who have succeded in making color by a judicious use of pigments.

#### Flame Resistance

With the advent of legislation prohibiting the use of highly flammable plastic compositions, the flame resistance of polyvinyl chloride stocks has become a matter of real concern. There still remains a considerable difference of opinion on the proper test method to be employed in the evaluation of flame resistance. Our laboratories have investigated this problem and have developed a new method for the evaluation of the flame resistance of plasticized polyvinyl chloride compositions,[3] (see Figure 1). The factors which appear to be of significance are: ignition time (time needed for the film to ignite after being heated to a definite high temperature in the vicinity of a free flame), the burning time (the length of time during which the film continues to burn), and the percentage of flame travel (the percentage of film that is burned). An empirical relation was worked out by which it is possible to compare various plasticizers and mixtures of plasticizers on a numerical basis. It is significant that the polyester resinous plasticizers rated quite well in these tests and showed long ignition times.

**Fig. 1. Flame Resistance Test: The Polyvinyl Chloride Film Is Allowed to Fall on a Heated Iron Surface, Whereupon the Vapors and the Film Are Eventually Ignited by a Pilot Light. Ignition Time, Burning Time, and Percentage of Flame Travel Are Measured, and an Empirical Flame Resistance Value Is Calculated**

Much work must be done in the development of both a test method and a plasticizer for flame-resistant polyvinyl chloride compositions. At present considerable progress has been made by the compounder through the use of certain flame-inhibiting pigments and fillers. Tricresyl phosphate remains the classical approach to the problem, although the use of this compound introduces other difficulties.

#### Toxicity

The question of toxicity can be answered completely only by laborious and time-consuming feeding tests of food products placed into contact with the plasticized film and by toxicological studies of animals exposed to the liquid or vaporized plasticizer itself. The factors which will determine to a large extent the potential danger of contamination of a food product are the solubilities of the plasticizer in oils and in water. Once again, when other factors are equal, high molecular weight materials may be expected to show promise in this respect. In any case, biochemical and biological tests are in order to form a firm basis for the selection of a non-toxic plasticizer.

[3] Dean L. Owens, "A New Method for the Determination of the Flame-Resistance of Polyvinyl Chloride Compositions," presented before Meeting-in-Miniature, Philadelphia Section, American Chemical Society, Jan., 1948.

#### Summary and Conclusions

A consideration of the various factors which contribute to the performance of a plasticizer in polyvinyl chloride compositions leads in the main to emphasis on the higher molecular weight compounds. Such derivatives may be expected to offer an optimum combination of resistance to migration and extraction, non-volatility, relatively low odor, and flame sensitivity. In view of the general acceptance of the ester group as a satisfactory compatibilitizing group having good heat and light stability, the adoption of a resinous polyester type of plasticizer is strongly indicated.

It is not possible to analyze fully the ultimate performance of a polyvinyl chloride composition in terms of the basic character of the plasticizer itself, but it is felt that a consideration of the fundamental factors involved should be of great assistance to the compounder in the design of superior products.

Much of the work associated with the development of improved methods for the evaluation of plasticizers in polyvinyl chloride has been carried out by Dean L. Owens of our research laboratories.

## Santicizer 141—Vinyl Plasticizer

A NEW vinyl plasticizer of the phosphate type from Monsanto Chemical Co., St. Louis, Mo., known as Santicizer 141, is specifically designed as a primary plasticizer for polyvinyl chloride and polyvinyl acetate film, sheet, or molded articles.

According to J. K. Craver, the company's plasticizer coordinator, Santicizer 141 is an efficient, flame-resistant, non-toxic plasticizer with excellent low-temperature flexibility and non-volatility and is compatible with a wide variety of resins, including polyvinyl chloride, cellulose nitrate, cellulose acetate-butyrate, ethyl cellulose, polymethyl methacrylate, polystyrene, and polyvinyl butyral resins. In polyvinyl chloride, Santicizer 141 possesses low volatility and imparts good low-temperature flexibility, excellent solvent resistance, and flame retardance. Suggested uses are curtains, table cloths, handbags, and tile.

The non-volatility and low-temperature flexibility of Santicizer 141 make it of value in free film, coated textiles, soles, handbags, shower curtains, and belts which must not become brittle in cold weather or stiffen with use. Heretofore flame-resistance has been obtained at the expense of low-temperature flexibility.

Preliminary laboratory tests indicate Santicizer 141 is free of any systemic toxicity and is non-irritating to humans, Mr. Craver further declared. These qualities are important for baby pants, hospital sheeting, and food bowl covers.

The limited supply of suitable plasticizers has long been a bottleneck in the production of high-quality, long-lived lacquers, films, and molded objects. Since four to six pounds are often needed for each ten pounds of resin, 100 million pounds of plasticizers are called for this year by the estimated production of vinyl films and moldings alone. To meet this demand Monsanto will increase its present production of Santicizer 141 to approximately 10 million pounds a year.

# Polyester Resins[1]

E. L. Kropa[2]

WHILE the term, polyester resin, has been used to describe many of the compounds cured by the loss of unsaturation, the term, thermosetting vinyl polymer, appears to be a preferable designation. One of the reasons why the term, polyester resin, originated was that during the war many of these compounds were considered secret, and that terminology was sufficiently descriptive to cover the materials in question without revealing their exact composition.

There was a saying in the last war that the purpose of a military secret was to keep the enemy misinformed about the state of one's own ignorance of the problem. This apt statement covers the compositions under discussion. Many of these compositions were known and published and were public knowledge in other countries.

### Development during the War

One of the early uses for this polyester or thermosetting vinyl material was as a backing for fuel cells during the war. Safeguarding aircraft gasoline was a serious problem during the early stages of the war; metal fuel cells were obviously impractical in military aircraft since any bullet would penetrate the cell and cause loss of gasoline.

With the development of an oil-resistant synthetic rubber it became possible to construct a fuel cell entirely out of various types of rubber. Synthetic rubber was necessary to prevent the aromatic constituents of gasoline from swelling the rubber composition. Natural rubber, which would swell in contact with the hydrocarbon fuel, was laminated to the synthetic rubber. Rupture of the fuel cell caused the natural rubber to imbibe gasoline and swell in such a way as to seal the hole. The fuel cells were at first surrounded by metal, but combat experience soon taught the designer that when a bullet entered the plane, it made a sharp hole in the metal as it entered, but caused a large jagged area as it emerged. Often the metal flowered in a manner that made it impossible to seal the resulting jagged area and prevent loss of gasoline.

It was obvious that some sort of shield was needed to protect the fuel cell from the metal. Experiments had revealed that laminated plastics might be employed as a type of protective armor and that best results were obtained when glass cloth was used as the web filler in such an assembly. Two problems arose when an attempt was made to use a glass cloth laminate as a safety layer. First of all, the high pressure used during laminating appeared to cause a type of degradation of the fibers. This may be attributed to the same phenomenon taught to fledgling chemists; that is, a scratch on a piece of glass does not damage the glass, but permits it to be cracked under stress.

The other limitation, and perhaps the more serious one, was that very large laminates were necessary. The fuel cells in one of the large bombers are quite large, and their protective armor must be of similar size. Certain of the shielding boards required were as long as 10 feet and as wide as three to four feet. At the same time there were no presses in this country to undertake such a molding problem, and, more important, the requisite materials for the manufacture of such new equipment were not available. Another factor to be taken into account was the impossibility of maintaining a uniform temperature and high pressure over such large areas to insure proper bonding. It was for this particular job that the low-pressure resins were developed. Large laminates were necessary; equipment was not available for conventional molding techniques; and the use of glass fabric appeared to yield better results when low pressures were employed.

It was natural that considerable secrecy existed concerning the nature of the resin composition during the early stages of the work. Later, however, as planes were shot down over enemy territory and the enemy given a chance to examine the particular type of assembly, many of the restrictions were partially eased. Nevertheless the nature of the composition was held under secrecy and resulted in various dodges being used to describe the resin; first as a low-pressure resin, then as a contact molding resin, and later as a 100% reactive resin. Such terms as "solventless varnishes" and "anhydrous thermosetting resins" have also appeared in the literature.

### Nature of Polyester Resins

One of the questions which arises is how do these contact resins differ chemically from conventional resinous materials. First of all, resins were initially products derived from natural gums and used primarily in coating compositions. Plastics, on the other hand, entered primarily into the molding field. Resins can be divided into two broad classes: the thermoplastic types and the thermosetting types. In general, thermoplastic resins are moderately high to very high molecular weight organic compounds. The molecular weight varies from approximately 4,000 up to perhaps one-half million. These molecules are more or less linear in nature. There are, on the other hand, so-called network polymers which consist of products tied together three-dimensionally into a network pattern. The molecular weight of these materials is very large, particularly in the cured form. In fact it is so large that it has never been determined since there is no solvent in which to dissolve or disperse these products, and without a medium there is no means of estimation.

There is another manner in which resins can be characterized: that is by whether they liberate any by-products during their preparation. When formation of water or other low molecular-weight materials accompanies the resin formation, the products are known as condensation resins; when no volatile material is lost, the resinous product is generally referred to as a polymerization material. This classification can be carried one step further. It is possible to have condensation resins as well as linear polymerization products. Either one of these reactions will yield a thermoplastic resinous composition either by the loss of water or by the loss of unsaturation. A similar situation exists with network polymers which can be made by loss either of water or unsaturation. It is therefore possible to make up a grid consisting of condensation and polymerization types, as well as thermoplastic and thermocuring types.

In summation, there are four types of resinous materials: (1) thermoplastic condensation materials made by elimination of water, and essentially linear in nature; (2) thermoplastic polymerization resins which are also linear in structure, but formed chemically by loss of unsaturation; (3) thermocuring condensation resins having a network system and formed through the loss of water; and (4) thermocuring polymerization resins also having a network structure, but formed by loss of unsaturation.

It is possible to place all known resinous materials, either natural or synthetic, in one of these four groupings. In the first group will be found such materials as nylon and many of the linear alkyd resins. In the thermoplastic polymerization type belong the largest number of the vinyl polymers, in fact, such a large number that the terms polymerization and thermoplastic are frequently considered synonymous. To this second group belong such products as polymeric methyl methacrylate, polystyrene, polyacrylonitrile, polyvinyl chloride, polyvinyl acetate, and some of the newer products such as polyethylene and polytetrafluoroethylene.

In the third group one finds such well-known materials as phenol-formaldehyde, urea-formaldehyde, and melamine-formaldehyde resins. Through over-simplification there is a tendency here also to consider all of the condensation materials as thermosetting in nature.

As for the fourth group, it is now generally known that any product possessing two vinyl groups in the same molecule is capable of forming a thermosetting polymerization product. Whereas styrene forms a linear product, two vinyl groups in the same molecule, as in divinylbenzene, lead to an infusible product upon polymerization. A similar situation exists with glycol acrylate, divinyl ethers, and divinyl ketones. Any of these products is capable of forming a cross-linked thermosetting polymer by polymerization reactions alone. Since no water is lost, these materials can be cured in any stage of polymerization. Since these products are of low molecular weight, they of necessity possess a very low viscosity. When an attempt is made to handle low-viscosity materials difficulties are experienced.

A more rational approach to the problem is to prepare a polymeric material having a plurality of unsaturated groups. Such a resinous material can then be made of any reasonable viscosity. During curing, chemical combination takes place between the unsaturated components and leads to an infusible final structure. It will be seen that such a system is very similar to that of rubber. Rubber possesses many unsaturated groups, and these can be brought together by vulcanization with sulfur.

A similar situation can be made to occur in resinous materials. By use of condensation procedures a high molecular-weight product can be prepared containing unsaturated groups. Just as in the case of rubber, superior cross-linkages in the resin may be secured through the addition of another component. The complete parallel can be seen in the use of a high molecular-weight polyester dissolved in a lower molecular-weight ester which is of greater chemical activity and leads to rapid curing.

To illustrate by a specific example, a resinous material is usually made by reacting a polyhydric alcohol with a polybasic acid, preferably an unsaturated acid. This condensation reaction is carried out until a product having a molecular weight of about 1,500 is obtained. This unsaturated polyester is then dissolved in a reactive solvent. Many of the vinyl monomers,

[1] Presented before the annual conference, Pacific Coast Section, Society of the Plastics Industry, Inc., Santa Barbara, Calif., Mar. 30, 1948.

[2] Research laboratories, American Cyanamid Co., Stamford, Conn.

such as vinyl aceate, acrylonitrile, methyl methacrylate, and styrene, can be used for this purpose. It is essential, however, that too low-boiling a composition is not selected because such a composition may possibly be volatilized during application or may blister during cure.

#### Crystallized Polymers

There is still another method by which one can classify resinous materials, and that is whether they possess an ordered or disordered arrangement. While it is generally difficult to consider resinous materials as crystalline, there is no doubt that this phenomenon exists, and the crystalline property of resins must often be taken into account. Consequently, an additional classification of resins can be made: those that are amorphous, and those that are crystalline. A crystalline material has everything organized conspicuously and under certain conditions of high orientation may exhibit considerable strength. It should be noted, however, that this strength is only in certain directions; there is a sacrifice of strength in other directions. On the other hand, an amorphous product is also organized, but deceptively so, since the order is of individual nature.

The best method to determine whether a resinous material is crystalline or amorphous is to subject it to X-ray diffraction. Ordinary liquids show as the principal scattering pattern a symmetrical ring located at some distance from the incident beam. Crystals show a collection of sharp spots when examined by X-ray scattering techniques. On the other hand, if a crystal is ground before such analysis, then sharp arcs are produced rather than single spots.

Some years ago rubber was subjected to examination by X-ray methods and showed an amorphous ring similar to that given by a liquid material. Subsequent test of a stretched rubber sample showed the material to be highly crystalline. This combination of amorphous and crystalline character was somewhat puzzling at first because there was no observable difference between stretched and unstretched rubber in appearance. This difference in structure was later found to result from changes which occur on a sub-microsconic scale in rubber.

There are marked differences, however, between a normally crystalline material and a crystallized polymer. The reason for this difference lies in the fact that common crystals, such as salt or sugar, are microscopic, and the crystal is very large compared to the molecular dimensions. The crystals in a polymer, on the other hand, are very small because the length and the nature of the chain allow the building up of aggregates in only limited areas. In a low molecular-weight compound a single molecule can exist in only one crystal, and many molecules enter into the arrangement of a single crystal. The reverse is true in the case of a polymer molecule which can be much larger than the crystalline dimensions because of its long length. It is thus possible for a single polymer molecule to be part of several crystals; that is, it may be part of one crystal, then kink and twist through an amorphous region, enter into another crystal-like portion, and then appear again in an amorphous part.

The relation between structure and crystallization of polymers is a difficult one to unravel. This fact can be seen by comparing rubber and gutta percha. Both of these polymers are derivatives of isoprene, but at room temperature rubber is soft and flexible; while gutta percha is hard and resilient. The latter can be stretched, but the stretching is of the nature of cold drawing, and retraction occurs only at elevated temperatures. The suggestion was made some years ago that rubber exists in the cis form of isoprene, while gutta percha is in the trans form. It is known, for example, that chloroprene possesses properties very similar to those of rubber although its configuration resembles that of gutta percha. At the present time there is no known way to change the nature of the isomerization during polymerization; during polymerization of isoprene there is a random distribution of cis and trans forms along the polymeric chains.

This is not the case, however, with condensation materials. Here one can select the appropriate cis or trans form of the acid, esterify the acid at appropriate temperatures low enough to avoid any isomerization, and obtain essentially a cis or a trans form of the same condensation product. This point can be demonstrated with maleic and fumaric polyesters; when these acids are subjected to esterification, they retain their geometric configuration so that it is possible to prepare the polymeric ester where the unsaturated group in the linear chain can exist in the cis and transforms, respectively.

Every glycol esterified with maleic or fumaric acid will not lead to a crystalline modification unless the glycol itself possesses a symmetrical structure. In order to clarify this point, it is perhaps better to return to the initial normal paraffin chain. A paraffin chain consisting primarily of methylene groups is a symmetrical structure, and examination by X-ray diffraction reveals that this arrangement is crystalline. When the molecular weight is sufficiently high, this polymer is a waxlike, tough product. One can modify this elementary paraffin chain by two methods, either through the addition of unsaturation, or by the introduction of substituent groups. Unsaturation in the paraffin chain affects the mobility and hinders free rotation. If similar groups are introduced simultaneously on each side of the paraffin chain, symmetry of arrangement and ability to crystallize are retained. When only a single group is introduced into the paraffin side chain, especially a large and bulky group such as phenyl, this grouping interferes with ease of packing, and an amorphous product results.

It is now possible to follow the changes which take place when glycols are introduced into the maleic or fumaric polyesters. Symmetrical glycols such as ethylene and trimethylene glycols yield, with fumaric esters, crystalline polymers. On the other hand, when diethylene glycol is introduced into the polymeric chain, it yields an amorphous product. When methyl groups are introduced into the glycol portion of the polymeric chain, it is necessary that they be introduced symmetrically. Propylene glycol tends to yield an amorphous ester even when fumaric acid is used. When methyl groups are introduced symmetrically, as they are in the case of isobutylene, one can obtain with the appropriate glycol a crystalline polyester with fumaric acid. This glycol is referred to as either 2,2-dimethylpropanediol or by the more appropriate name, neopentyl glycol.

It is possible to draw an even closer analogy between the unsaturated polyester and the rubber with respect to the type of material involved. Natural rubber is combined with sulfur, and accelerators are used to increase the rate of vulcanization reaction. With the thermosetting vinyl types the polyester itself resembles the rubber; styrene is the counterpart of sulfur, and peroxides are used to accelerate the reaction.

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## SPE Sections Hear Plastics Experts at Local Meetings

APPROXIMATELY 75 members and guests attended a meeting of the Baltimore-Washington Section, Society of Plastics Engineers, Inc., on June 8 at the Engineers' Club, Baltimore, Md. Guest speaker was Harold M. Parsekian, director of sales and technical service for the chemicals division of The Glenn L. Martin Co., who discussed the development of Marvinol VR-10 resin.

The company's wartime research program which culminated in Marvinol VR-10 vinyl resin also resulted in 425 different plastics applications for the aircraft industry, Mr. Parsekian said. Marvinol was shown to have the greatest suitability for high-temperature, high-speed processing equipment newly developed in the plastics industry. The speaker reviewed the production of the resin and stated that its applications range from shoes to shower curtains, garden hose to floor coverings, and hundreds of other uses. He also traced the growth of the Martin chemicals division from initial research, pilot-plant operations at Case Institute of Technology, and finally to the construction of the new production plant at Painesville, O., geared to annual production of 25 million pounds of Marvinol.

#### Chromium Plating of Molds

The New York Section, SPE, held its last regular meeting of the season on June 8 at the Hotel Sheraton, New York, N. Y., President Arthur Nufer, Bakelite Corp., presiding. Approximately 25 members and guests heard a talk on "Chromium Plating of Molds" by Joseph C. Rogers, sales manager of Industrial Hard Chromium Co., substituting for W. A. Crowder, of the same company, who had originally been scheduled to present the address.

Mr. Rogers pointed out that hard chromium plating, as distinguished from the softer decorative types, is a field still under development and occupying much of the status of an art at present. Because of the difficulties involved in plating complex mold surfaces and the use of a dark-colored plating solution which prevents inspection of the work during plating, much of the work is done on the basis of past experience modified to fit the particular piece being plated. When properly applied, a hard chromium plating is four times harder than the base steel of the mold and will greatly prolong the life of the mold.

The speaker emphasized that the chromium finish will reflect the surface finish of the steel being plated. The steel surface must be given the desired finish prior to plating as the chromium plate will not fill in any pits or scratches that may exist on the mold surface. Unlike decorative chrome plating, the hard chromium plate is generally from 0.0003- to 0.001-inch

thick. When a final chrome coloring operation is desired, the plated chromium coating must be left below the specified thickness to allow for build up during coloring.

In hard chromium plating, anodes made of refined lead are used and must fit the contours of the part being plated. In some cases as many as 50 or more anodes are used for one part in order to achieve uniform plating thickness. The placing of these anodes is a precision job, Mr. Rogers said, since they will cause rough spots in the finished plate if too close to the piece.

Because of its hardness, the chromium plating is quite brittle. The plating is generally heat treated for three hours at 360° F. to relieve stresses and reduce brittleness. Plated stock should never be annealed because the chromium will adhere permanently to the base metal and cannot be stripped off in the future. Plated molds should be ground very slowly, using shallow cuts, or surface cracking of the base steel will occur and the chromium coating will flake off. As for polishing the chromium plating, Mr. Rogers recommended the use of a very soft stone to remove fuzzy edges.

Hard chromium plated molds can be stripped and replated many times if done properly, the speaker declared. This stripping is affected by means of a 50% muriatic acid in water solution which removes only the plating and does not damage the base steel. Stripping will sometimes cause surface passiveness of the steel base which must then be refinished prior to replating. The appearance of milky spots on an otherwise shiny chromium-plate surface is caused by a residual film of lubricant or rust-preventative oil on the mold before plating. Under proper procedures the steel mold is given both solvent and electrolytic cleaning operations to remove such film and to secure better adhesion of the deposited chromium coating.

Mr. Rogers' talk was followed by an extended and animated discussion period of questions raised by the members. The speaker emphasized that hard chromium plating is only as good as the plating procedure used. For proper plating a carefully engineered set-up must be employed and due consideration given to the individual requirements of the part being plated.

The Section will hold its next meeting on September 14 at the Hotel Sheraton. The speaker and his topic for this meeting will be announced at a later date.

### Mold Cavities of Stainless Steel

Approximately 28 members and guests of the SPE Buffalo Section attended a dinner-meeting on May 28 at the Park Lane Restaurant. Guest speaker was Charles E. Dawson, Dawson Associates, Inc., who discussed "Stainless Steel Mold Cavities." With the aid of sample cavities and parts, Mr. Dawson outlined the advantages and economies of stainless steel mold cavities as used in many injection molds now in production, particularly in the toy field. A wide variety of low-pressure laminated parts made by Atlas Plastics, Inc., were on display at the meeting, including ducts and other products used in modern aircraft construction.

It was announced that the 1948 SPE Prize Paper Contest will be supervised in the Buffalo Section by a committee headed by George Goepfert. The best local paper submitted will be awarded a prize of $100 and will be entered in the national competition.

### Moxness and Cameron before Newark Section

The Newark Section held its last regular dinner-meeting of the current season on June 9 at the Newark Athletic Club, Newark, N. J. Approximately 100 members and guests attended the dinner, and 140 were present at the technical session following.

Two technical talks were presented. Sven K. Moxness, Minneapolis-Honeywell Regulator Co., spoke on "Present Developments in Steam Preheating of Phenolic Materials," and Hugh J. Cameron, W. T. LaRose & Associates, Inc., discussed "Dielectric Heating as It Applies to the Plastics and Allied Industries." The paper by Mr. Moxness was the one he gave before the SPE national meeting in January, which was abstracted in our March issue (page 754). Mr. Cameron's talk was identical with the paper he gave before the SPE New York Section on February 10, a report of which also appeared in our March issue (page 755).

Following the talks it was announced that the Newark Section would give prizes to the two best papers entered locally in the 1948 SPE Prize Paper Contest in addition to entering them in the national contest. The author of the best local paper will receive a prize of $75 plus an expenses-paid trip to the SPE national meeting next January in Philadelphia, Pa. The second best paper will be awarded $25.

The group's next regular meeting will be held on October 13 at the Newark Athletic Club.

### Symposium on Mold Finishing

The June 1 meeting of the SPE Chicago Section, at the Merchants & Manufacturers Club, Chicago, Ill., featured a symposium on "Mold Finishing." Roger F. Waindle, general manager of Sapphire Products Division, Elgin National Watch Co., spoke on the Hyprez diamond finishing system, and Vern L. Nichols, Vapor Blast Mfg. Co., discussed "Liquid Honing" of metal parts.

Mr. Waindle stated that the main reasons for obtaining a better finish on molds was to give higher production, less wear, and better appearance. While a perfect means of measuring the relative finish of a surface has yet to be found, two methods now in use give a reasonably good idea of the surface irregularities and make a record, in graphical form, of the surface being analyzed. One method uses a beam of light which is reflected by a moving mirror on to photographic paper, and the other method makes a graphical record by electrical means from the movement of a pointer over the surface.

The speaker described in some detail the type of surface which can be obtained by using the five principal methods of finishing: namely, turning, grinding, honing, lapping, and super-finishing. He discussed the action of a tool in cutting the metal surface and the changes in crystal structure which occur at this surface because of the excessive heat generated during a turning operation. Since grinding is in effect a turning operation with the abrasive particles acting as a large number of cutting tools, grinding has the same disadvantages as turning.

The Hyprez diamond finishing system is a method of lapping or polishing by hand or by machine, using fine particles of diamonds, Mr. Waindle said. The diamonds are carried in a synthetic vehicle which is especially compounded to prevent settling out of the particles and which contains wetting agents to assist the honing operation. The diamond compound is applied by means of a gun applicator designed for ease of handling and economy of use. Simple lapping tools made from iron, copper, wood, Bakelite, or felt can be used. The diamond compound is available in a wide variety of particle sizes, ranging from 0.25-micron to 40 microns in average diameter, to fit every type of finishing job.

Mr. Nichols described the use of his company's liquid honing process, which consists of equipment for blasting with fine abrasive particles in wet form. The abrasive is recirculated and used until exhausted. The process is widely used to improve the surface finish of all types of metal parts, being used in some cases prior to other finishing methods and in other cases to impart a final finish. When used on plastics molds, the process has a number of advantages, including improved ejection of molded parts from injection machines, and elimination of considerable hand polishing of parts which must be so finished.

Group Chairman William L. Hess, Anesite Co., announced that the annual golf outing will be held on August 20 at a site to be announced at a later date.

### South Texas Section Meetings

The SPE South Texas Section held a regular dinner meeting May 19 at the Ben Milam Hotel, Houston. Approximately 34 members and guests heard F. B. Williams, Crown Machine Tool Co., discuss the theory of injection molding. Mr. Williams described the development and improvement of the modern injection molding presses and illustrated his talk with an elaborate display of plastic products manufactured on the latest-type presses. Besides this talk a film by the Gorton Machine Co. entitled, "An Exact Duplicate," was shown to the assemblage. In a brief business session the group voted to begin an intensive membership drive.

The South Texas Section met again on June 16 at the Ben Milam Hotel with some 45 members and guests attending. Walter P. Bussart, Tennessee Eastman Corp., showed the film, "The Story of Tenite." Next he gave a talk on Tenite, its properties and applications, which was followed by a question and answer period.

A very interesting talk on guerrilla warfare in the Philippines was given by Major I. D. Richardson, who served in the war as a major in the Army and as an ensign in the Navy. The meeting also featured a large exhibit of injection molded products made of Tenite by Blackwell Plastic Molding Co.

The group's next meeting will be held on October 20 at the Ben Milam Hotel.

### Franz on Costs and Prices

The Cleveland Section, SPE, met on May 28 at Tomlinson Hall, Case Institute of Technology. Charles Franz, consultant to the plastics molding industry, spoke on "Estimating Manufacturing Costs and Establishing a Selling Price." Mr. Franz's talk consisted of a detailed discussion of a typical cost study and afforded many practical pointers of interest and benefit to the audience. A talk on "The Political Situation in Palestine" was given by Mr. Kalfayan, who has spent many years in the Lebanon area and was a former teacher at the American School in Beirut.

This was the Section's last regular meeting of the season. An outing will be held during the summer, and further particulars will be announced at a later date. The next regular meeting is scheduled for September.

### Plastics from Sugar

The New Orleans Section held a dinner-meeting on June 3 at the New Orleans Hotel, with president H. A. Levey, American Products Mfg. Co., presiding. A brief business session was held to discuss preliminary arrangements for an outing during the summer. At the technical session Leon Godchaux II, Godchaux Sugars, Inc., discussed the development of plastics from sugar and sugar-cane products. The talk was divided into three parts, discussing bagasse and its derivatives, molasses and its derivatives, and sucrose and its derivatives.

The group's next meeting will be held on the second of September and also at the New Orleans Hotel.

### For Better Preforming for Plastics

Approximately 30 members and guests attended the last meeting of the current season of the Rhode Island & Southeast Massachusetts Section, SPE, on June 9 at the Providence Engineering Society Bldg., Providence, R. I. At the technical session H. J. Lee, Defiance Machine Works, Inc., read a paper on "Studies in Preforming" by Charles H. Frantz, plastics consultant, and Ralph O. Janson, of the Defiance company.

After a brief history of preforming the paper presented extensive data and information on the use of preforming for general-purpose, medium-impact, and high-impact thermosetting plastics. Emphasis was placed on the following points: (1) a point of maximum density of a preform is reached for a given material at a given pressure; (2) a practical range of density of a preform can be set for minimum loss of weight in handling; (3) careful preparation of the material is necessary before preforming; (4) gaging of the preform dimensions is a means to control of density for a given material; (5) all of these characteristics follow the same pattern for all materials studied; and (6) at a given pressure die areas should vary with the material being preformed.

No business session was held, but it was announced that the group's next regular meeting will be held in the fall, probably on October 13. Further details will be announced in the future.

### A New Look at Plastics

The SPE Detroit Section held an open meeting on May 14 on the subject of "A New Look at Plastics," in the Horace H. Rackham Educational Memorial Bldg., Detroit, Mich. Invitations were sent to engineers in the Detroit area, and the meeting was very well attended, including representatives of all of the automotive, rubber, and other large industries in the area. Speakers at the meeting were John M. DeBell, DeBell & Richardson, Inc., who discussed engineering and technical features, and Charles A. Breskin, *Modern Plastics* magazine, who spoke on the sales and the promotional aspects of the subject.

Mr. DeBell gave an interesting and comprehensive review of the development of the plastics industry, including developments in types of materials, molding and forming methods, and applications. Among the many subjects discussed were preheating, urea and melamine resins, alkyd resins, thermoplastics, vinyl compounds and pastes, low-temperature polymerization of rubber and the adaption of the process to other high polymers, polyamides, polyester resin saturated glass fibers and plastic foams.

## CALENDAR

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| July 17. | Chicago Rubber Group. Annual Golf Outing. Acacia Country Club. |
| July 22-23. | Division of Rubber Chemistry, A.C.S. Summer Meeting. Mayfair Hotel, Los Angeles, Calif. |
| July 24-25. | Los Angeles Rubber Group, Inc. Annual Summer Outing. Catalina Island. |
| July 31. | Buffalo Rubber Group. Outing. Lancaster Country Club. |
| Aug. 14. | Connecticut Rubber Group. Outing. |
| Aug. 15. | Northern California Rubber Group. Summer Outing. Corry Creek Park. |
| Aug. 20. | Chicago Section, SPE. Annual Golf Outing. |
| Aug. 23-Sept. 19. | City of New York. Golden Anniversary Exposition. Grand Central Palace, New York, N. Y. |
| Aug. 24. | New York Rubber Group. Annual Golf Tournament. Winged Foot Golf Club. Mamaroneck, N. Y. |
| Sept. 2. | New Orleans Section, SPE. New Orleans Hotel, New Orleans, La. |
| Sept. 14. | New York Section, SPE. Hotel Sheraton, New York, N. Y. |
| Sept. 17. | Philadelphia Rubber Group. Annual Outing. Oak Terrace Country Club. |
| Sept. 17. | Southern Ohio Rubber Group. Engineer's Club of Dayton, Dayton, O. |
| Sept. 21. | Buffalo Rubber Group. Westbrook Hotel, Buffalo, N. Y. |
| Sept. 24. | Boston Rubber Group. Somerset Hotel, Boston, Mass. |
| Sept. 27-Oct. 1. | Third National Plastics Exposition. Grand Central Palace, New York, N. Y. |
| Sept. 30. | Northern California Rubber Group. |
| Oct. 1. | Detroit Rubber & Plastics Group, Inc. Detroit-Leland Hotel, Detroit. |
| Oct. 5. | The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif. |
| Oct. 5-7. | New England Materials Handling Exposition. Mechanics Hall, Boston, Mass. |
| Oct. 12. | Washington Rubber Group. |
| Oct. 13. | Newark Section, SPE. Newark Athletic Club, Newark, N. J. |
| Oct. 15. | New York Rubber Group. Henry Hudson Hotel, New York, N. Y. |
| Oct. 19. | Buffalo Rubber Group. Westbrook Hotel, Buffalo, N. Y. |
| Oct. 20. | South Texas Section, SPE. Ben Milam Hotel, Houston, Tex. |
| Oct. 28. | Northern California Rubber Group. |
| Nov. 3-5. | American Society of Body Engineers, Inc. Annual Convention. Rackham Memorial Bldg., Detroit, Mich. |
| Nov. 8-10. | Division of Rubber Chemistry, A.C.S. Book Cadillac Hotel, Detroit, Mich. |
| Nov. 9. | Washington Rubber Group. |
| Nov. 18. | Rhode Island Rubber Club. Crown Hotel, Providence, R. I. |
| Nov. 18. | Northern California Rubber Group. |
| Dec. 3. | Philadelphia Rubber Group. |
| Dec. 10. | New York Rubber Group. Christmas Party. Henry Hudson Hotel, New York, N. Y. |

Mr. Breskin discussed the rapid growth of the plastics industry from 55 million tons in 1929, to 247 million pounds in 1939, 900 million pounds in 1945, and at present about 1,200 million pounds. As for application, the 1948 automobile uses an average of more than 10 pounds of plastics parts or, in a peak year, about 45 million pounds for the industry. The refrigeration industry uses more than 25 million pounds; the radio industry takes two million pounds; vacuum cleaners consume five million pounds; 10 million pounds go into small electrical appliances; and another million are used in general applications, such as stove handles, knobs, etc. This means an engineered use in household appliances alone of well over 50 million pounds annually of plastics parts. The speaker noted that this acceptance is strangely at variance with opinions on plastics which have been expressed by some of the very engineers who are using them.

## Plastics Exposition to Feature New Machines

A SHOW far more comprehensive than its previous offerings is expected by The Society of the Plastics Industry, Inc., for its Third National Plastics Exposition, to be held in Grand Central Palace, New York, N. Y., on September 27 to October 1. "Progress in Plastics" is the slogan of the exposition, which will emphasize recent strides made by the industry and its prospects for future growth and expansion.

Demonstrations of new processes and special machinery will be featured on a larger scale than in the past. Some of the interesting developments to be displayed include a new 50-ton press and a 50-ton automatic molding machine with preforming attachment made by F. J. Stokes Machine Co.; the new electronic bonding machine of Singer Sewing Machine Co.; and the new automatic vinyl film sealing equipment made by Radio Receptor Co., Inc.

Injection molding machines will be demonstrated by leading companies such as Fellows Gear Shaper Co., Giddings & Lewis, Stanley Sapery Co., Van Dorn Iron Works Co., and others, with several companies showing new models in action. Reed Prentice Corp. will operate 10 ounce and 4 ounce machines demonstrating the injection technique. Stamping presses for marking and decorating will be exhibited by Peerless Roll Leaf Co. and other manufacturers.

In the plating and polishing field Nutmeg Chrome Co. will show chrome plating and polishing of molds and dies; while Acme Scientific Co. will offer polished molds. Steiner Plastics Mfg. Co. will demonstrate complete plastics fabrication techniques. High-frequency dielectric heating units will be exhibited by the Girdler Corp. and others with recent models.

In addition to the above-mentioned companies there will be dozens of concerns demonstrating all the machine processes, such as low-pressure and cold molding, extruding and laminating, assembly of intricate parts, new applications of infrared techniques, and many others. Various steps and stages of manufacture will be shown, from the raw plastic material to the finished consumer product. Interesting new machine tool models will be on view, some of which will be full-size in action; while others will be displayed in miniature.

# Scientific and Technical Activities

## Rubber Division, A. C. S., Summer Meeting Program

THE program and the abstracts of the papers to be presented at the summer meeting of the Division of Rubber Chemistry, A. C. S., in Los Angeles, Calif., on July 22 and 23, at the Mayfair Hotel, have been announced and are given below. There has been a change in the scheduling of the papers from that given in our June issue on page 387. The technical sessions will start at 2:00 p.m., Thursday, July 22, not at 10:00 a.m. as previously announced. Registration will begin on the morning of July 22 at 9:00 a.m.

H. E. Outcault, St. Joseph Lead Co., chairman of the Division, will open the meeting at 2:00 p.m., July 22, and will preside at the banquet on that evening at the Biltmore Hotel at which the Charles Goodyear Medal will be presented to David Spence. In addition to the technical session on the afternoon of July 22, there will be technical sessions starting at 9:00 a.m. and 2:00 p.m. on July 23. The business meeting of the Division is scheduled for 11:20 a.m. on the morning of July 23.

D. C. Maddy, Harwick Standard Chemical Co., is chairman of the local committee on arrangements and will arrange hotel accommodations for members and guests planning to attend this meeting. Hotel reservation forms and registration forms for the meeting and the banquet have been sent to members. A reservation form for the annual summer outing of The Los Angeles Rubber Group, Inc., at Catalina Island on Saturday, July 24, and Sunday, July 25, has also been mailed to members who may also wish to attend this even..

The titles, authors, and abstracts of the 21 papers to be given at the three technical sessions are as follows:

THURSDAY AFTERNOON—JULY 22

**Photoelastic Applications in Rubber Technology.** Photoelastic applications in analysis and design have had wide and varied use in the study of stresses in rigid bodies. Very limited use, however, has been made of the photoelastic method in the specific problems of rubber technology. In this field considerable complexity is involved because of the large strains encountered and the nature of the stress-strain relations.

Some of the problems associated with the application of the photoelastic method to rubber products will be discussed briefly. This discussion will include suitable low modulus photoelastic materials, implications involved in large deformations, physical and photoelastic constants of suitable materials, and the necessity of handling conditions of non-linearity for quantitative results.

In this paper it is proposed to demonstrate the qualitative photoelastic technique using suitable low modulus materials. Stress in the Winklemann "B" tear specimen and in a Gates modified Graves tear specimen will be compared (slides). Extension of the method to quantitative analysis, with reference to the physical and photoelastic constants and the conditions of non-linearity, will be presented briefly. The use of models cut from sections of molded products will be illustrated. Frozen stress applications using stressed products will be included. Suggested uses of the method will be given for various types of rubber products. James A. Hurry and Douglas Chalmers, Gates Rubber Co., Denver, Colo.

**Measurements of Mechanical Properties of Rubbers at Audio Frequencies by a Twin Transducer.** Apparatus has been developed for measuring the dynamic viscosity and rigidity of rubber-like solids in small oscillating deformations. A plate rigidly attached between two identical coils in two permanent magnet loudspeakers shears a pair of disk-shaped samples when a driving current is passed through the coil. The output voltage from the other coils is compared in amplitude and phase with the driving current as follows:

The vector difference between the output voltage and the potential drop across a variable resistance in series with the driving coil is measured by a high impedance vacuum tube voltmeter, and by changing the resistance this voltage is adjusted to a minimum value. The minimum voltage reading and the corresponding resistance value are proportional to the imaginary and real parts, respectively, of the complex mechanical admittance of the system.

The method has two advantages over the more familiar resonance devices: (a) the amplitudes of motion, which need not be measured directly, are extremely small, thus minimizing any non-linear effects, or temperature change due to heat dissipation; (b) a continuous range of frequencies, spaced as closely as desired, is available without adjusting masses.

Representative data for the dynamic viscosity and rigidity of a high molecular weight polyisobutylene over the range 60-700 c.p.s. at room temperature will be given. The values for this material, although it is devoid of crosslinks, are similar in magnitude to those of a lightly vulcanized rubber. John D. Ferry, Robert S. Marvin, Edwin R. Fitzgerald, University of Wisconsin, Madison, Wis.

**A Study of Electrostatic Changes Produced during Mastication of Rubber and GR-S.** The electrostatic fields, commonly called "static electricity," produced by masticating rubber and GR-S on a laboratory mill, have been measured with a new electrostatic field strength meter which records not only the strength of the field, but also its polarity.

This new device, which is described, is essentially our "electrostatic modulator" into which a standard reference voltage of the proper frequency and phase has been introduced to enable polarity, as well as field strength, to be measured. This instrument shows that rubber starts out with a very highly negative electrostatic field which becomes less negative as mastication proceeds. The field in some cases goes to zero (0) value; and in others, reverses polarity and goes to a positive (+) value. This decrease in negative charge or an electronic rearrangement directly indicates an oxidation reaction. This supports the classic work of Busse and Cotton, who found that mastication is an oxidation process. By using this equipment as a processing control, it should be possible to improve on quality through better dispersion and also reduce costs through proper sequence and timing of operations.

Some correlation of Mooney plasticity with electrical contact potential and changes in electrostatic field strengths has been shown for rubber broken down on a laboratory mill.

Data on GR-S do not show this great decrease in electrostatic field strength or contact potential as mastication proceeds. Electrostatic curves for GR-S polymerized at low temperatures as well as for cross-linked GR-S-60 are shown.

The importance of these electrostatic attractive and repulsive fields around rubber during milling is discussed also in relation to the possible effect on rate of incorporation and dispersion of pigments. R. S. Havenhill, L. E. Carlson, J. J. Rankin, St. Joseph Lead Co. of Pennsylvania, Monaca, Pa.

**Nitrosomenthane and Its Significance in Free Radical Reactions.** Chemical reactions which appear to involve free radicals or atoms have become increasingly important in processes of particular interest to the rubber, petroleum, and chemical industries. The use of small amounts of nitric oxide for the detection of chain reactions in gaseous mixtures has been studied by many investigators (Hinshelwood, *et al*). Speculation as to the mechanism of this inhibition has been extensive. Recently the present authors have isolated nitrosomethane for the first time as its dimer by the photolysis of t-butylnitrite.[1]

$$(CH_3)_3CONO \rightarrow (CH_3)_2CO + CH_3NO$$

Since no ethane could be found, it was believed that this formation of nitrosomethane occurred intramolecularly. It is not implied that the cission of the the O-NO and the C-$CH_3$ bonds occur simultaneously, for it is the former bond which is broken first. However, the $(CH_3)_3CO$ radical is apparently sufficiently unstable to liberate almost immediately a $CH_3$ radical which combines with the NO before it is far removed.[2]

To isolate nitrosomethane by the reaction of a $CH_3$ radical with NO it is necessary to employ relatively low temperatures; otherwise isomerization to formaldoxime occurs:

$$CH_3NO \rightarrow CH_2NOH$$

At 125° C. approximately 10% conversion per minute is effected in the vapor phase. Even in the solid state at 32° C. dimeric nitrosomethane undergoes change as evidenced by the depression in its melting point with time. At sufficiently high temperatures the nitrosomethane simply has a transitory existence. This is undoubtedly the case for the vapor phase decomposition of di-t-butyl peroxide in the presence of nitric oxide.[3]

When NO is employed for the detection of free radicals at high temperatures, the effects of the possible oximes produced from the various free radicals should be considered. Thus the transitory inhibition by NO for the thermal decomposition of n-butane might be attributed to the production of free radicals from the decomposition of the oximes (produced from the corresponding nitroso compounds), rather

[1] *J. Am. Chem. Soc.*, 70, 1516 (1948).
[2] Compare, W. A. Waters, "Chemistry of Free Radicals," p.125, Oxford (1948).
[3] *J. Am. Chem. Soc.*, 70, 88 (1948).

# *Use*

# STATEX·B

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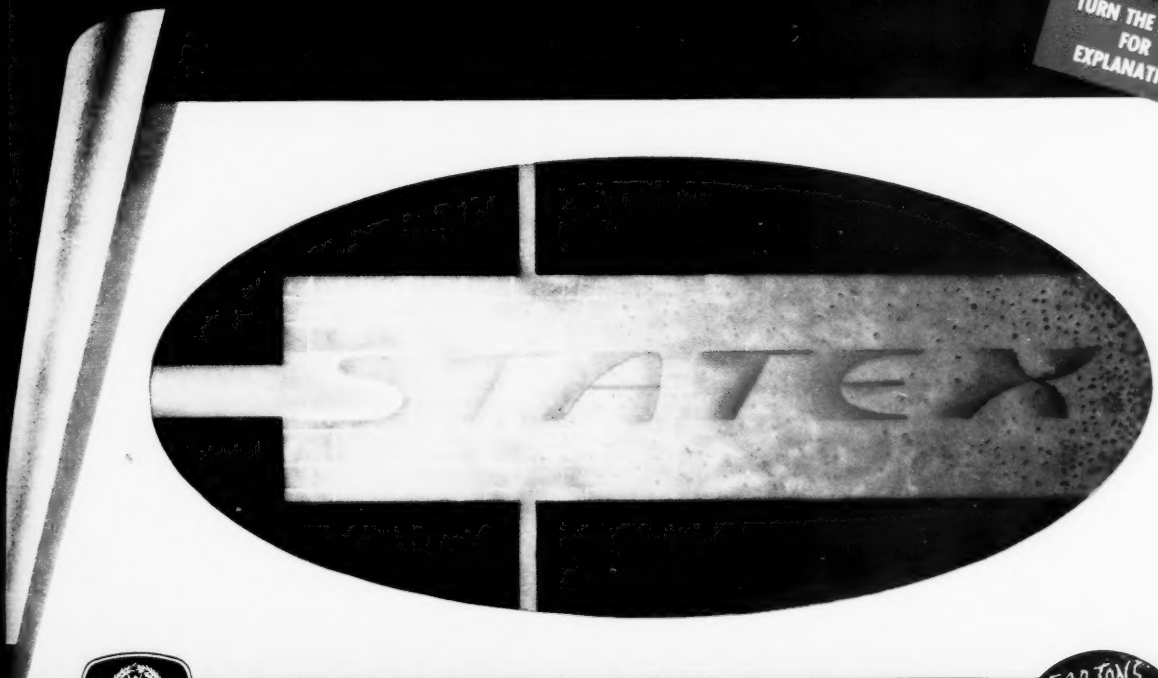


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than the equilibrium reaction given.[4] Thomas F. Doumani and Clarence S. Coe, Union Oil Co. of Calif., Los Angeles.

**Drying of Latex Rubber Deposits.** The drying of rubber articles made from either natural rubber or synthetic latex is one of the most important unit processes used in such manufacture. Articles are usually made by either straight dipping or coagulant dipping although other processes such as gelation or casting are also used to a limited extent. In all instances the removal of water by drying is necessary.

The general principles of drying apply in all cases, but because of the constant decrease of porosity which occurs during the procedure due to the shrinkage of the deposit, it becomes progressively more difficult completely to remove the moisture. Such factors as absolute humidity, relative humidity, temperature, and circulation of the air affect the drying.

The problem of migration of the moisture from within the deposit in a progressively more solid rubber deposit is considered. By correct design and control of conditions the rubber articles can be dried properly and economically, but if these factors are not controlled, many difficulties can arise which will lead to an inferior rubber product.

Illustrations included show the various changes occurring during the drying operations. Flowable films, such as those created by straight dipping, can become wetter after being put into a drying oven. Blisters can be formed between the deposit and the form, but the formation of such blisters can be controlled.

All these difficulties can be overcome by the proper design of ovens and the proper applications of fundamental drying principles. E. O. Partridge and M. E. Hansen, American Anode, Inc., Akron, O.; paper will be presented by R. A. Lees, American Anode, Los Angeles.

**Emulsion Polymerization at Low Temperatures.** The production of Philprenes A and B aroused great interest. These are chemical rubber copolymerized from butadiene and styrene at 41 and 14° F. Their outstanding characteristic is high performance when fabricated into tires. Besides they exhibit superior tensile strength, abrasion, and tear resistance coupled with easy processability.

This major achievement became possible only as the result of developing fast, low-temperature emulsion polymerization recipes. Two types are described, those initiated by diazo thioethers and oxidation-reduction recipes catalyzed by iron pyrophosphate complexes. These recipes were developed by subjecting various reagents to comparative polymerization tests and by a systematic study of the adjustment of reactants with the object of determining optimum concentrations. A reconsideration of all ingredients of emulsion polymerization recipes was required to obtain satisfactory operation at low temperatures. Soluble emulsifying agents were needed, as were also freezing point depressants, which would not retard the reaction and which could be recovered cheaply. The concentration of modifier was lowered to avoid the production of excessively low molecular weight products. A very careful adjustment of initiator ingredients was made, which investigation led to the discovery of interesting stoichiometric relations. Studies of the influence of temperature and electrolyte concentrations were required because of the many anomalous effects observed.

From this fundamental investigation has come a superior polybutadiene, chemical rubber tires which outwear those from natural rubber, and the demonstration by X-ray analysis that low-temperature rubber consists largely of butadiene units extended in a *trans* configuration. C. F. Fryling, C. A. Uraneck, W. M. St. John, S. H. Landes, Phillips Petroleum Co., Phillips, Tex.

**The Effect of Diolefin Type and Concentration on the Properties of Butyl.** Although Butyl polymers can be made by copolymerizing isobutylene with a variety of diolefins, isoprene is the diolefin used in the commercial production of Butyl rubber (GR-I). The choice of isoprene was based on its availability, the polymer quality, and its applicability in the process. At present the major part of GR-I production goes into inner tubes, primarily because of its air holding properties, and excellent tear resistance. However the market is growing for Butyl in other uses, as mechanical goods, wire insulation, curing bags, proofed goods, farm tractor tires, etc. Polymer variations, as well as compounding changes, are important in obtaining optimum properties for the above uses. This paper deals with the effect of the diolefin type and degree of unsaturation on the properties of Butyl polymers, with a minimum discussion of compounding variations.

A comparison is made of copolymers of isobutylene with isoprene, butadiene, dimethylbutadiene, and piperylene. So far as the tensile-elongation-modulus properties are concerned, the piperylene polymers are inferior to the others. For all types the rate of cure increases rapidly with increased unsaturation as would be expected. It is shown that Butyl polymers cured to relatively high moduli suffer some loss in tensile and tear properties. The trend in the rubber industry, however, is toward GR-I-15, a polymer of higher unsaturation than GR-I, because of the faster cure rate which results in a higher state of cure and better inner tube performance.

More extensive comparisons of Butyl containing isoprene and butadiene, which are of commercial interest, show that the latter is superior in steam-air aging at high temperature. This point is of interest for the preparation of superior curing bags. The butadiene-type polymers also show less tendency to overcure, maintain a higher tensile strength and tear resistance at high modulus levels, and have superior acid resistance. On the other hand, isoprene-type polymers are superior in rebound, Goodrich flexometer, and retraction rate at low temperature. L. M. Welch, J. F. Nelson, H. L. Wilson, Esso Laboratories, Standard Oil Development Co., Elizabeth, N. J.

FRIDAY MORNING—JULY 23

**Effect of Some Accelerators on the Physical Properties of Nitrile Rubber Vulcanizates.** Thiazole acceleration has been commonly used in nitrile rubber stocks intended for widely different applications. The purpose of this investigation was to determine whether thiuram acceleration or a no-sulfur acceleration would give better properties than thiazole acceleration for applications which require minimum drift or minimum stress relaxation.

All stocks tested but one were identical except for the type and amount of accelerator and curing agent contained. The exception contained a coumarone indene resin instead of ester plasticizers. The accelerator-curing agent combinations studied follow: (1) thiazole disulfide with normal sulfur, (2) thiuram monosulfide with normal sulfur, (3) increased thiuram monosulfide with reduced sulfur, and (4) thiazole with thiuram disulfide and selenium.

The stocks were evaluated for strength, mechanical, and rheological characteristics. The strength characteristics were the usual tensile properties and tear resistance. The mechanical characteristics were hardness, static and dynamic modulus, resilience, and energy absorption. The rheological characteristics were compression set and stress relaxation at 194° F., and drift at 82 and 194° F.

Accelerator-curing agent combination (4) gave the best strength characteristics with combination (1) next best. Combination (3) gave the most desirable rheological properties and what would usually be considered the best mechanical properties, i.e., it yielded the highest resilience and least difference between the static and dynamic moduli. Combination (2) was the next best in these respects.

The main effects of substituting coumarone-indene resin for the esters were an improvement in strength characteristics and a change in mechanical characteristics toward increased hardness and reduced resilience.

Evidence was obtained that an approximate correlation exists between compression set and stress relaxation and between compression set and drift, at least when the tests are performed at the same temperature and initial deflection. This condition enables the relative stress relaxation and drift of vulcanizates to be evaluated by the comparatively simple compression set test. R. R. James, R. E. Morris, I. P. Seegman, Mare Island Naval Shipyard, Vallejo, Calif.

**Variability of a Typical Commercial Oil Resistant Synthetic Rubber.** In connection with an experimental project on aircraft hydraulic packings, it was necessary to determine the variation in properties of the finished product which could be expected from variability within the original polymer. This study was accordingly undertaken to provide such information regarding Perbunan 18, a butadiene-acrylonitrile copolymer popularly employed for this application.

To "calibrate" the properties employed, is was necessary to determine the experimental or testing error within a given lot. This factor was determined by repeated testing, employing a series of compounded batches from the master lot. Lot-to-lot variability was determined on a series of lots selected at random from the manufacturer's inventory of this polymer.

A standard compounding recipe was employed for the entire study. Plasticity and extrusion index were determined on the unvulcanized material. Stress-strain properties, hardness, and swelling in hydrocarbon-base hydraulic fluid were measured on the vulcanized stocks. The data were analyzed statistically as outlined in the "A.S.T.M. Manual on Presentation of Data."

Results indicate that the variation among lots with this particular polymer is no greater than the normal testing error within a given lot. Normal frequency distribution curves were obtained for plasticity, extrusion, hardness, elongation, and swelling; whereas tensile strength failed to conform to a normal distribution. Tensile stress at a lower elongation produced a more normal type of distribution curve than the corresponding stress at a higher elongation. C. L. Smith and LaVerne E. Cheyney, Battelle Memorial Institute, Columbus, O.

**Practical Accelerator and Sulfur Ratios for H.A.F.-Type Blacks in Natural**

[4] *Ibid.*, 61, 1024 (1939).

**and GR-S Rubbers.** With the advent of established and consistent production of high abrasion furnace blacks, a modification in compounding technique presents itself owing to the different effects on the rate of vulcanization as compared to channel-type blacks. In view of the efficiency of the manufacturing process for H.A.F. blacks compared with the current economics of channel black manufacture, and also the merits of a high abrasion furnace black in compounding natural or synthetic rubber products, one becomes cognizant of the need of a practical approach toward the best use of these modern blacks.

Data presented show the effective vulcanization of N-cyclohexyl-2-benzothiazole sulfenamide, mercaptobenzothiazole and benzothiazyl disulfide accelerators in conjunction with sulfur ratios when comparing H.A.F. blacks with channel blacks in GR-S and natural rubbers. Typical recipes are shown exemplifying the differences in physical properties, processing characteristics, and extrusion properties as obtained in the laboratory and the factory. It is further indicated that when H.A.F. blacks are used in natural rubber, different accelerators will give variance in abrasion characteristics and scorching tendencies. G. E. Popp and L. Harbison, Phillips Petroleum, Bartlesville, Okla.

**Reclaimed Rubber Today *versus* Prewar.** A review is presented of the transition in reclaimed rubber from a straight natural rubber base to the processing of materials containing both natural rubber and GR-S. Comparison is made between typical natural rubber prewar reclaims and present-day reclaims based on mixtures of natural rubber and GR-S.

These comparisons are carried through end-product compounds in which reclaimed rubber has long played an important role. Physical data are shown for compounds typical of the following products: (1) passenger tire carcass, (2) passenger tire undertread, (3) automotive mat, (4) black heel, and (5) hard rubber storage battery container.

Except for hard rubber, data are given both before and after oven aging.

Results indicate that replacement of the prewar types of reclaimed rubber with grades representative of present-day manufacture can be made without sacrifices of quality and with the advantage of improved processing.

Development of new grades of reclaimed rubber is outlined which are expected to play an increasingly important role in providing new compounding materials for the rubber industry. A. Fuhrmann and Robert L. Randall, Midwest Rubber Reclaiming Co., East St. Louis, Ill.

**Some Aspects of Rubber-Rayon Adhesion.** It is now well known that rayon fibers must be treated with an adhesive to obtain sufficient bond for use in tires and other rubber products. This paper describes some of the adhesion factors which must be considered in product design.

Methods for measuring rubber to fiber adhesion have not yet been standardized, although satisfactory results have been obtained by both the strip and "H" tests. Statistically treated data collected on these two test methods show the strip test to have greater precision. The strip method is also to be preferred for its general simplicity.

Natural latex resorcinol-formaldehyde is compared to a reclaim dispersion casein dip using pure gum, zinc oxide, and reclaim carcass stocks. The dependence of bond strength on temperature is shown as well as the relation to physical properties of the carcass stocks. Graphs presented show effects of Geer oven aging.

A discussion covers the requirements of a good bonding agent and of test fabrics, the overall factors effecting bond strength, and test methods and analysis of failures.

Of particular importance is the analysis of failed specimens which show that separation ordinarily occurs at one of three points: (1) within the stock, (2) at the stock-adhesive interface, and (3) at the adhesive-fiber interface.

In giving an adequate definition of adhesion, the type of failure must be shown, as the numerical value alone does not reveal the weakest component. Improvement in adhesion can only come by recognizing the weakest element in subsequent strengthening. The point of failure should be watched, in particular, when dealing with a progressive series of measurements as it may change within the series. H. H. Gillman and R. Thoman, Gates Rubber.

**The Dynamic Characteristics of Neoprene Vulcanizates.** Modern advancements in the application of elastomeric materials to engineering problems have indicated the need of more adequate information about the dynamic characteristics of their vulcanizates. The adaptability of certain synthetic elastomers to products requiring resistance to sunlight, heat, oil, etc., has been retarded by this lack of information. We refer to conditions of service where the limitations of natural rubber curtail its use.

This paper considers some dynamic properties of neoprene vulcanizates. Data are presented on the effect of variations in loading on such properties as resilience, heat build-up, dynamic modulus, and dampening. We propose to show the differences revealed in these properties in neoprene and in natural rubber vulcanizates as the filler content is increased. Other variables, such as time and temperature of cure and test conditions, are discussed. N. L. Catton, E. H. Krismann, W. N. Keen, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

**The Effect of Die Surface Irregularities upon Results of the Tensile Test for Vulcanized Rubbers.** Examination of the inner surfaces of two tensile test dies of recent manufacture revealed that the inside surfaces of the cutting edges were characteristically tool marked. Measurements of the tensile properties of a variety of vulcanized rubber stocks using these dies to prepare the specimens as well as a die with improved cutting surfaces indicate that surface imperfections (tool marks) on the former dies result in significant lowering of test values of tensile strength and ultimate elongation in most of the cases examined. In one instance the difference approached 10%.

To supplement these results replicas were made of the die-cut rubber surfaces using a casting resin, and the replicas were examined with a brush surface analyzer. The surface profiles so obtained showed that while the maximum irregularities were of the same order of magnitude for the three dies examined, the die with the improved cutting surfaces produced specimens whose surfaces were not marred with multitudes of small, sharp nicks as was the case with the specimens cut with the unimproved die surfaces. C. H. Klute, Shell Development Co., Emeryville, Calif.

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**S-Polymers for Food Packaging.** The S-Polymers, a new series of all hydrocarbon thermoplastic resinous copolymers, possess many of the attributes desirable for a food packaging material. These polymers process very satisfactorily on conventional types of rubber and plastics fabricating equipment to form either self-supporting films or coatings on paper, cloth, glass fabrics, and even metal foils. Their outstanding characteristics in addition to their processability include excellent resistance to the penetration of moisture vapor and gases. These properties are coupled with good physicals such as tensile strength, elongation, colorless appearance, electricals, and light stability. The good moisture and gas resistance in conjunction with the other characteristics outlined makes these resins interesting as packaging media for fresh fruits and vegetables, dried foods, and similar applications.

Experimental data presented show that the S-Polymers may be employed advantageously for packaging fresh and dried fruits. Packages made up of calendered S-50 Polymer film prolonged the storage life of the fruit, retaining a high percentage of the original weight with very little, if any deleterious effects on appearance, food value, or edibility. Such tests were conducted over periods of several months' duration.

Investigations are also reported revealing that some system of ventilation or some modifications of the S-50 polymer is necessary to establish the proper balance between respiration and transpiration of the fresh fruit. This is dictated by the fact that the S-Polymers are so resistant to the penetration of gases and moisture that packages, if completely sealed, will not permit the normal life sustaining processes of fresh fruit to take place. Experiments are shown which indicate that mechanical ventilation of the packages, if judiciously employed, is quite adequate. Other investigations gave some indication that modification of the resin through compounding may serve the same purpose.

The studies reported in this paper indicate that S-Polymers may be used to advantage in a variety of packaging applications including fresh fruits, dried foods, dry chemicals, tobacco, frozen foods, etc. W. A. Fairclough, Enjay Co., New York, N. Y.; R. G. Newberg and J. R. Briggs, Esso Laboratories.

**Properties of Some Oil-Resistant Adhesives.** This paper will cover the reasons for work on oil-resistant adhesives and will attempt to present the properties of oil-resistant adhesives having been made from three different base materials: namely, neoprene, N type copolymers, and "Thiokol." We propose to present data indicating the relative strength and oil resistance of these materials when made into oil-resistant adhesives. We hope also to make a comparison of the working properties of the three types of adhesives. We plan to spend a little time in explaining the test methods we have used. We shall indicate where some of these adhesives have been found useful, and we shall try to point out the need of further work on oil-resistant adhesives. F. Wehmer, A. F. Lindner, G. F. Schmelzle, Minnesota Mining & Mfg. Co., St. Paul, Minn.

**Some of the Physical and Chemical Properties of "Thiokol" PR-1.** "Thiokol" PR-1 is the latest of the polysulfide type of crude synthetic rubbers to be submitted to the rubber industry. It may be classified as a tailor-made polymer because its development was based on including as many desirable characteristics of the polysulfide type of rubbers as could be incorporated into this polymer. Laboratory research and commercial field uses of PR-1 show that many of these characteristics have been realized.

Vulcanized articles show good dimensional stability in both aromatic and non-aromatic fuels. This property brings it in the classification of an oil-resistant rubber. However, going a step further than merely being oil resistant, "Thiokol" PR-1 shows exceptionally low swell in the majority of commonly known and used solvents which are out of the range of classification of the ordinary oil and gasoline types. Figures on some of the volume swell characteristics of other synthetic rubbers in comparison with "Thiokol" PR-1 will be given.

Another characteristic of this material is its good low-temperature flexibility without the aid of an extractable plasticizer. Some comparisons of this feature between "Thiokol" PR-1 and other synthetic rubbers will be made.

"Thiokol" PR-1 shows resistance to compression set over a wide range of temperatures, and a comparison of this feature with some of the other synthetic rubbers will be made basing the evaluations of the other synthetics on data taken from the published literature.

Besides the above-mentioned characteristics "Thiokol" PR-1 exhibits the excellent aging characteristics of all of the previous types of "Thiokol" crude synthetics. Some basic information on compounding and factory processing together with physical data will be included. Walter E. Boswell, Thiokol Corp., Trenton, N. J.

**Comparison of Cements for Bonding Nitrile Rubber to Steel.** The relative effectiveness of chlorinated rubber and phenolic resin cements for bonding a nitrile rubber vulcanizate to steel has been determined from the standpoints of reliability, resistance to gasoline, and boiling water, and strength at temperatures up to 350° F. The bond strengths were determined in tension by the A.S.T.M. procedure.

It was found that a proprietary chlorinated rubber cement and the phenolic resin cement are equally reliable and are somewhat better in this respect than ordinary chorinated rubber cement, that phenolic resin bonds withstand aromatic gasoline and elevated temperatures better than chlorinated rubber bonds, and that chlorinated rubber bonds withstand boiling water better than the phenolic resin bond. J. W. Hollister, R. E. Morris, and P. A. Mallard, Mare Island Naval Shipyard.

**Neoprene AC-Resin Cements.** One of the problems of the rubber manufacturer has been the development of a one-application cement for the adhesion of cured rubber to metal and other surfaces. One cement developed for this purpose has been the combination of Neoprene AC and a resin in a suitable solvent.

Thermoplastic terpene phenolic[5] has been the resin most widely used.

In an effort to find other resins to substitute for the terpene phenolic a series of experiments was conducted using modified phenolics[6] and a pure phenolic.[6]

In tests of adhesions to metal (sheet tin), wood, and cotton duck, and bond strength of rubber plies, the pure phenolic cement was found comparable or superior to the terpene phenolic cement.

The rubber stocks tested were ordinary factory stocks of 40 to 60 Shore in hardness. Natural rubber, neoprene, GR-S, "Thiokol" PR-1, X Type copolymer, and Butyl stocks were tested.

The pure phenolic gave good adhesion to sheet tin, wood, and duck. It gave excellent bond strength, 15 pounds' stripping pull, between plies of neoprene; good bond strength, 10 to 12 pounds' stripping pull, between plies of X type copolymer, Butyl, and "Thiokol" PR-1. The bond strength between plies of natural rubber and between plies of GR-S was poor, and plying up of these rubbers using this type of cement is not a safe procedure.

The best composition of cement tested consisted of 50 parts of resin to 100 parts of neoprene. This was dissolved in enough solvent to give a smooth cement coat.

All cements were prepared and all tests were performed with factory and field use of the cements as the major requirement to be fulfilled. Grover S. Ramsay and George I. Petelin, Goodyear Rubber Co., San Francisco, Calif.

**Ultra-Accelerators in GR-S.** A literature survey fails to reveal a complete rubber compounding survey of an homologous series of the thiurams or metal dialkyldithiocarbamates as vulcanization accelerators. Therefore the methyl, ethyl, *n*-propyl, *n*-butyl, and *n*-amyl derivatives of the tetraalkylthiuram mono- and disulfides, and the lead, zinc, selenium, and copper salts of the metal dialkyldithiocarbamates were prepared for testing. The scope of this paper is limited to a study of these products on an equal weight basis in a typical GR-S stock reinforced with 50 parts of EPC black.

In general the results show that an increase in the alkyl group decreases the activity of the accelerator. The slightly slower curing rate obtained with each methylene addition in the alkyl group is readily compensated, particularly in the lower members of the series, by slightly increasing the cure time without appreciable sacrifice in tensile strength, modulus, or elongation. The ethyl derivatives are safer processing, less scorchy, and afford greater freedom from bin cure than the corresponding methyl compounds.

The various members in the homologous series, when employed as secondaries, may be interchanged with little effect on the physical properties of the vulcanizates.

The thiuram disulfides are more active accelerators than the monosulfides. The order of decreasing accelerator activity for the metal dialkyldithiocarbamates is copper, selenium, zinc, and lead. These generalities apply particularly to the ultras when used as primaries; however, the same trends, but to a lesser degree, are observed when they are employed as secondaries with mercaptobenzothiazole-type accelerators.

The selenium dialkyldithiocarbamates are faster curing vulcanizing agents than are the corresponding thiuram disulfides. As vulcanizing agents, these two homologous series follow the same order of accelerator activity as observed for their use as primaries, but to a more marked degree. The higher members of the series particularly exhibit a pronounced decrease in rate of cure as vulcanizing agents. G. M. Wolf and C. C. de Hilster, Sharples Chemicals, Inc., Wyandotte, Mich.

**Uses and Applications of Tuf-Lite, a New Plastic Material.** During the past several years the technology of plastics and the technology of rubber have been coming closer and closer together. Tuf-Lite is a union of both plastics and rubber. Its properties and uses are described, and some predictions made as to what the future holds for this material. H. R. Thies, Goodyear Tire & Rubber Co., Akron, O.

[5] Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.

[6] Reichhold Chemicals, Inc., Detroit, Mich.

## New Tire Developments

A TALK by A. W. Bull, director of development of the tire division, United States Rubber Co., on "New Tire Developments" was the feature of a dinner-meeting of the Detroit Rubber & Plastics Group, Inc., on May 21 at the Detroit-Leland Hotel, Detroit, Mich. In one of the best attended and best received meetings in the Group's history, the assemblage of approximately 275 members and guests included many members of The Tire and Rim Association, Inc., the Detroit Section of the American Automobile Association, automotive body and chassis engineers, and tire manufacturers' representatives.

Dr. Bull began his talk with a generalized review of the functions of a tire and said that as yet no material has been found to surpass rubber in meeting the tread and sidewall requirements of a tire. By means of slides, trends in tire cost and mileage from 1908 through 1946 were shown. The rubber industry has consistently reduced the tire cost per mile over this span of years, and despite rising material and labor costs tire prices now are substantially the same as prewar.

The qualities desired in a tire and the procedure for obtaining an optimum balance of these qualities were discussed in some detail. Fundamental studies in tire construction and design were responsible for the introduction of the first low-pressure tire in 1946, the U. S. Royal Air-Ride. Embodying the principle of a narrower, flatter tread on a somewhat larger carcass, so designed as to give less shock and greater stability, comfort, and blow-out resistance, the tire was first introduced as a replacement tire but is now being widely adopted as original equipment.

The synthetic rubber picture is changing at present, Dr. Bull also said. Although good enough to get us through the war emergency, GR-S was inferior to natural rubber in heat generation, abrasion resistance, cut growth, and tensile strength. New low-temperature polymerized rubbers are distinctly improved in all of these qualities and it appears as though treads can be made from this new rubber which will surpass the performance of natural rubber.

Inner tubes of Butyl rubber are remarkable in their ability to hold air, but suffer in comparison with natural rubber tubes in one limited service condition, the speaker explained. Extremely low service temperatures coupled with low pressures cause a condition referred to as "low temperature buckling" with Butyl tubes. This fault affects only about 10% of tire usage and is hardly sufficient to cause abandonment of Butyl as these deficiencies are being overcome by experimentation.

After the talk the gathering viewed a travelogue film, "Wheels Across India," produced by Dodge Brothers Division, Chrysler Corp., depicting the country, people, and living conditions of India.

Group Chairman C. W. Selheimer, U. S. Rubber, announced the program for the annual summer outing, scheduled for June 25 at the Forest Lake Country Club, Pontiac, Mich. Dr. Selheimer also announced that the Group's fall meeting would be held on October 1 at the Detroit-Leland Hotel and that L. Sperberg, Phillips Petroleum Co., would speak on "Carbon Black in Low-Temperature Chemical Rubber."

## Panel Discussion on Compounding Mechanicals

A PANEL discussion on "Compounding of Mechanical Rubber Goods" featured the technical session of the June 1 meeting of The Los Angeles Rubber Group, Inc., at the Hotel Mayfair, Los Angeles, Calif. Approximately 80 members and guests attended the technical session and heard the discussion by a panel composed of Adelbert Schade, Ohio Rubber Co.; Andrew L. Matelik, Kirkhill Rubber Co.; Fred Woerner, Reeves Rubber Co.; Raymond B. Stringfield, Fullerton Mfg. Co.; and B. R. Snyder, R. T. Vanderbilt Co. George W. Miller of W. J. Voit Rubber Corp., chairman of the technical group, acted as moderator.

The questions submitted to the panel, together with their discussions, follow:

**Q. 1.** At what price does reclaim become uneconomical as compared with GR-S and/or natural rubber in a low-priced mechanical?

**A.** Mr. Schade presented a formula for calculating this economic balance, which is as follows:

$$\frac{\text{Pound cost} \times \text{Sp.Gr.}}{\%\ \text{Rubber Hydrocarbon}} = \text{Equiv. rubber cost}$$

A whole tire reclaim at 8¢ (Sp.Gr. 1.20 and Rubber Hydrocarbon 52%) is equivalent to an 18½¢ rubber price. So when rubber or GR-S is 18½¢ or under, there is some question as to whether reclaim is economical. Of course in some jobs reclaim will always be used to help processing and other conditions.

**Q. 2.** What is the cause of reversion in rubber stocks?

**A.** Reversion in rubber stocks might be explained as a depolymerization defect which can be caused by heating in the absence of air, according to Mr. Stringfield. A compound containing a low sulfur content or one cured with ultra-accelerators is more liable to be subject to this defect. With ultra-accelerators it is important to obtain the optimum cure to avoid revision. Mr. Snyder confirmed the statement that 0.5=1% tellurium materially aids the prevention of revision. Selenium is also helpful in this regard, but it not so effective as tellurium.

**Q. 3.** How would you compound a natural rubber, nearly a pure gum stock, so that it calenders consistently free of blisters with 75% of each run going back as trim in subsequent calender runs?

**A.** The necessity of using 75% trim was, in general, questioned by the panel. Mr. Stringfield, however, outlined the fundamentals of keeping away from blisters in calendering by saying that this problem was as much one of processing as compounding. In this regard the stock should be used as stiff as possible for calendering so that it will not be overly soft for later operations. Hot calendering should help in this regard. The addition of a high-styrene copolymer such as Pliolite should be of some help.

**Q. 4.** What accelerator would you recommend for an open-steam cured GR-S stock heavily compounded with carbon and clay to give a required hardness of 80 Shore?

**A.** Mercapto-benzothiazole was recommended by Mr. Snyder as the preferable accelerator under the conditions outlined.

**Q. 5.** How important is dispersion in mechanical rubber product service?

**A.** Proper dispersion of the various compounding ingredients was stated by Mr. Woerner to be highly important if a high-quality product is to be obtained. It is particularly important to disperse completely small quantities of critical ingredients such as accelerators. In this regard, the benefit of masterbatching was pointed out. To obtain a uniform stock there are four main steps, all of which are exceedingly important: first is the selection of the type of pigment to be used; second, the amount of pigments; third, the order of incorporation; and fourth, the method of mixing. Each of these features must be given careful consideration and properly handled if a high-quality product is to be obtained.

**Q. 6.** What percentage shrinkage should be designed into normal molds?

**A.** As a rough rule of thumb, a shrinkage 3/16-inch per lineal foot can be used, according to Mr. Matelik. Whenever a close tolerance is specified for a finished product, however, it is desirable to measure the shrinkage of the particular stock involved. This measuring is easily accomplished by curing a piece in a standard shrinkage mold, using dimensions 2- by 2- by 2-inch. Highly loaded stocks will have less shrinkage than light loadings, and, in general, synthetic stocks shrink more than natural.

**Q. 7.** How can you bond neoprene to hard rubber?

**A.** The problem presented here was that of putting a neoprene tread on a hard rubber caster wheel. According to Mr. Schade, the first item of importance is to have fresh clean stocks. The bond is further enhanced by using a high percentage of a tackifying softener such as pine tar. Tie gum high in softener might also be of some help. Extruding the neoprene stock over the hard rubber stock while the hard rubber stock is fresh, will generally give favorable results.

**Q. 8.** What type of polymer is best suited for production of soling compounds?

**A.** For a cheap sole regular GR-S is recommended. For a high-quality product a butadiene-styrene copolymer with a high styrene content is preferable. A number of these are currently on the market under various trade names.

**Q. 9.** What would be your recommenations for a low-temperature service compound which would be resistant to both aromatic and aliphatic fuels?

**A.** The problem presented here was that of making airplane gasoline tank fittings which would be resistant to the aromatic fuels commonly encountered in the United States, and also aliphatic fuels normally obtained in other parts of the world. The panel agreed that this problem was difficult, for which none of them had an immediate answer.

The dinner session, attended by some 158 members and guests, featured a talk on "American Morals and American Destiny" by Robert E. Fitch, dean of the faculty at Occidental College. Entertainment was provided by the Group's Barber Shop Quartet and by group singing. The following door prizes were distributed to: Monty Montgomery, Martin, Hoyt & Milne, 50-foot vinyl hose; Al Federico, C. P. Hall Co., traveling bag; Mr. Snyder, alarm clock; A. Legman, Legman Trucking Co., electric corn popper; Bob Short, Kirkhill Rubber Co., traveling kit; and W. J. Thomas, Firestone Tire & Rubber Co., a special prize.

### Golf Tournament

The Los Angeles Group held its annual spring golf tournament on June 4 at the Wilshire Country Club, with a record attendance of 43 members participating. Prizes were won by the following: blind bogey, Larry Keltner, B. F. Goodrich Co.; longest drive, Dick Grand, Goodrich; most accurate approach, Bob Bowen, Xylos Rubber Co.; low net score, Waitland Wiley, Goodyear Tire & Rubber Co.; low total putts, Fred Cota, Goodyear; high gross, T. Hoyle, B. F. Goodrich Chemical Co.; second highest gross, Bart Thompson, Moulded Products Co.; low gross, Ed Spurlin, Ace Rubber Co.; second lowest gross, Tracy Park, Lamb Rubber Co.; and in the most sand traps, Red Steller, Fullerton Mfg.

## Rubber Industry Use of Lead and Zinc Pigments

STATISTICS have recently been released by the Bureau of Mines, United States Department of the Interior, Washington, D. C., on shipments by industries of lead and zinc pigments during 1947, as compared with shipments during 1946.

Litharge shipments to all industries amounted to 167,505 tons in 1947 and 133,799 tons in 1946. Of the 1947 total, 2,205 tons went to the rubber industry as compared with 2,131 tons in 1946. Lithopone shipments totaled 165,024 tons in 1947 and 147,001 tons in 1946. Lithopone shipments to the rubber industry reached 3,085 tons in 1947, a substantial increase over the 1,607 tons shipped in 1946.

Total shipments of zinc oxide were 160,771 tons in 1947 and 157,851 tons in 1946. The rubber industry took 82,248 tons of zinc oxide in 1947, a reduction from the 83,776 tons taken in 1946. As for leaded zinc oxide, total shipments were 81,459 tons in 1947 and 67,971 tons in 1946. Of these totals, 131 tons went to the rubber industry during 1947, as compared with 166 tons in 1946.

**Panel Members at Los Angeles Group June Meeting:** ***(Back Row)*** **Fred Woerner and B. R. Snyder;** ***(Front Row)*** **George W. Miller, R. B. Stringfield, A. Schade, and A. L. Matelik**

## Boston Group Outing

FOR the twelfth consecutive year the Boston Rubber Group enjoyed perfect weather at its annual summer outing, held on June 18 at the Woodland Golf Club, Newton, Mass. Approximately 470 members and guests participated in the afternoon sports program, which included a golf tournament, softball games, and horseshoe, darts, and putting contests. The outing concluded with a dinner served under a tent, followed by the distribution of door prizes to everyone attending and the awarding of prizes to contest winners. Much appreciation was expressed to the contributing companies and to the outing committee consisting of Chairman Ralph McCurdy, Hood Rubber Co., assisted by Thomas Edwards, Acushnet Process Co., Harry Atwater, also of Hood, and John Andrews, Godfrey L. Cabot, Inc.

Prizes were awarded to the following in the golf tournament: kicker's handicap, F. Burger, Kleistone Rubber Co., A. B. Harding, Monsanto Chemical Co., Mr. McCurdy, J. J. O'Neill, Shell Oil Co., J. Magraine, New England Tape Co., H. C. Jones, New Jersey Zinc Sales Co., and J. F. Lang, Bakelite Corp.; low gross, A. N. Clapp, A. E. Nelson, Hood, W. A. Maguire, United Carbon Co., C. H. Hamilton, Raffi & Swanson, Inc., and W. B. Richardson, American Mineral Spirits Co.; low net, S. McCarthy, Shell Oil, A. W. Bryant, Binney & Smith Co., S. J. Szulik, Acushnet, and T. W. Ashley, T. C. Ashley & Co.; nearest pin, W. A. Woodcock, Carbide & Carbon Chemicals Corp., and D. P. Bryant, Resinous Products & Chemical Co.; longest drive, G. Milne; most 3's, E. H. Kroepel, C. K. Williams & Co.; most 8's, T. N. Loser, Thompson, Weiman & Co., Inc.; highest score, E. B. Hodgdon, J. T. Baker Chemical Co.; and fewest putts, Saul Palais, American Resinous Chemicals Co.

In the darts contest, first and second prizes went to J. Stewart, Hood, and C. M. Grafton, Goodall-Sanford, Inc., respectively. P. L. Blanchard and E. N. Weber, both of Hood, took first prize in the horseshoe pitching contest. In the softball tournament the team captained by Mr. Ashley took first prize, the Avon Sole Co. team took second place, and third prize was won by the Huber's Tigers team. The putting contest saw J. J. Mondino, CPA, win first prize, H. D. Bainbridge, Boston Varnish Co., took second place, and E. Ismirian, Acushnet, was runner-up.

## Ontario Group Field Day

THE Ontario Rubber Section C.I.C., held its first annual field day on June 5 at the Rouge Hills Golf & Country Club, West Hill, Ont., Canada. Approximately 60 members and guests participated in the afternoon golf tournament and the evening dinner and card party. Some 20 golf prizes were awarded and 19 door prizes were also distributed.

Election of officers for the 1948-1949 season was held after dinner, and the following were elected: chairman, D. F. Walker, Dunlop Tire & Rubber Goods Co., Ltd.; secretary-treasurer, Steward Murray, Gutta Percha & Rubber, Ltd.; Hamilton representative, Lloyd Webber, Firestone Tire & Rubber Co. of Canada, Ltd.; Toronto representative, A. Barraclough, Canadian Triangle Wire & Cable Co., Ltd.; and Kitchener representative, W. H. Bechtel, Kaufman Rubber Co., Ltd.

## Filler Flours Available

FILLER flours made from hard black walnut shells and pecan shells are being marketed by Harwick Standard Chemica Co., Akron, O., for use in rubber and plastics compounding. These flours are graded from a 325-mesh fineness up to a 10-16-mesh grade; the coarser grades are suited to airblast abrasive purposes.

Flours of this type have been in use as fillers for plastics and have recently been used in rubber compounding where light-colored filler body is needed without too great an impairment of resilience. The texture of black walnut-shell flour particles is such as to provide more firmness and density in rubber compounds. The coarser grades of walnut-shell flour suggest their use as a fine, mild abrasive in soaps. Pecan-shell flour has a slightly higher oil content and softer texture than walnut-shell flour.

Shell processing is being carried out under controlled conditions in a specially equipped plant in the Missouri-Oklahoma area where the nuts are harvested. C. J. Harwick, president of Harwick Standard, has announced that his company will maintain warehouse stocks of the new shell flours in various grades at five strategically centered points: Boston, Mass., Trenton, N. J., Akron O., Chicago, Ill., and Los Angeles, Calif.

## Akron Group Meeting

THE largest assemblage in the history of the Akron Rubber Group, 610 members and guests, attended the annual summer outing on June 18 at the Lake Forest Country Club, Hudson, O. The program included an afternoon golf tournament, in which 232 golfers participated, followed by a buffet dinner in the evening and the drawing of door prizes contributed by some 127 rubber and supplier companies. W. D. Anderson, Godfrey L. Cabot, Inc., was general chairman of the outing and was assisted by the following sub-committee chairmen: W. H. Ayscue, E. I. du Pont de Nemours & Co., Inc., R. H. Marston, Binney & Smith Co., L. V. Cooper, Firestone Tire & Rubber Co., Dan Doherty, Herron Bros. & Meyer, John M. Walsh, Xylos Rubber Co., and R. F. Wolf, Columbia Chemical Division of Pittsburgh Plate Glass Co.

In the golf tournament, low gross honors were divided by Art McGeorge and C. A. Damicone; while second honors were shared by Mason Kirkland and Byron McCreary. William Whittaker had low gross on the first nine holes, and Neil Sherwood was low on the second nine. The prize for high gross on the first nine went to Charles Sitz, and T. T. Wilson took the high gross prize for the second nine. Low net was won by J. C. Wood, and blind bogey prizes went to A. W. MacAlonan, A. Parsons, H. H. Fink, Ray Jones, T. Viock, R. E. Metzger, R. W. Hobson, C. J. Adelman, and C. N. Lehto. A number of special contests were included in the program. The prize for the longest drive on the tenth hole went to Mr. McCreary; while Fred Ellis had the longest left-handed drive on the same hole. R. J. Easton came the closest to the pin on the fifteenth hole. Prizes for reaching the 211-yard ninth green in one shot were won by George Lenhart, Mr. Damicone, Frank Leonard, C. Brees, F. B. Shaw, F. E. Palmer, J. M. Wallace, William Vecsey, P. M. Eyster, H. E. Eckert, Mr. Lehto, and J. M. Kean.

## Nitrile Rubber Gaskets

A TALK on "Evaluation of Nitrile Rubbers for High-Temperature Gasket Service," by Joseph W. Hollister, Rubber Laboratory, Mare Island Naval Shipyard, featured the May 27 meeting of the Northern California Rubber Group in the Claremont Hotel, Berkeley, attended by 35 members and guests.

Mr. Hollister said that a determination was made of the relative merits of commercially available nitrile rubbers for high-temperature gasket service. Silastic was also included in the comparison because of its reputed excellence for such service. The principal criterion in the test was retention in sealing pressure after aging at 300° F., but changes in hardness and tensile properties of the rubbers were also noted. The speaker stated that no clear correlation was found between acrylonitrile content of the rubbers and retention of sealing pressure, hardness, and tensile properties upon aging, although medium acrylonitrile content appeared to favor retention of sealing pressure, and high acrylonitrile content seemed to favor retention of hardness and tensile properties. Silastic seemed to be not better than certain of the nitrile rubbers for service equivalent to 70 hours at 300° F., but gave indications of superiority for more severe service.

At the business session, R. R. James, also of the Mare Island Rubber Laboratory, reported favorably on arrangements being made for attendance at the Division of Rubber Chemistry, A.C.S., meeting in Los Angeles on July 22 and 23. A history of the Northern California Rubber Group, prepared at the request of the Rubber Division, was read by Herman J. Jordan, E. I. du Pont de Nemours & Co., Inc. William Elwell, California Research Corp., reported on arrangements being made for the Group's summer outing, to be held on August 15 at Curry Creek Park, near Oakland.

The Group's next meeting will take place on June 24. Robert B. Stewart, Dow Corning Corp., will speak on "Silicone Rubbers."

## Smith Memorial Lecture

THE American motorist can look forward to better tires from synthetic rubber, Carl S. Marvel, professor of chemistry at the University of Illinois and former president of the American Chemical Society, said in the Edgar Fahs Smith Memorial Lecture, sponsored jointly by the Philadelphia Section, A.C.S. and the University of Pennsylvania at the Franklin Institute, Philadelphia, Pa., on May 20. The quality of GR-S has been greatly improved by the recent development of the rapid redox process which permits low temperature polymerization.

In the redox process liquid butadiene and styrene are first emulsified with a soap, and the polymerization reaction started by an activator. It is probable that many new redox systems will be developed, Professor Marvel said, and that new emulsifiers, catalysts, and reducing activators will be tried. Each new system will require careful study to balance all of the factors involved because of the extreme sensitivity to exact balance which is characteristic of the redox reaction. Many variations of the redox process developed in the United States, Germany, and Great Britain are now being tested on an industrial scale, Professor Marvel said.

In another approach to the problem of improving synthetic rubber, chemists have tried substituting various other compounds for butadiene and styrene in the basic GR-S formula, the speaker declared. Isoprene and piperylene have been used in place of butadiene, with surprising results. A commercial grade of isoprene polymerizes slowly, but extremely pure isoprene polymerizes faster than pure butadiene. Piperylene also polymerizes too slowly to be of great use. More than 30 compounds have been tested as substitutes for styrene, all of them resulting in products closely resembling GR-S.

It appears that greater changes in the quality of a copolymer synthetic rubber can be achieved by changing the method of polymerization with one set of monomers than by changing the ingredients in a given polymerization system, Professor Marvel concluded.

## Washington Group Meetings

THE Washington (D. C.) Rubber Group held its third regular meeting on May 18 at a Navy Department building. A constitution was adopted, and the gathering viewed a film on the manufacture of synthetic rubber presented by Goodyear Tire & Rubber Co.

The Group also held a dinner-meeting on June 18 at the Hotel 2400, when Walter Belson spoke on the "Psychology of Humor." A social hour preceded the meeting.

## Canadian Rubber Division Meets

A VERY successful meeting of the Rubber Division of the Chemical Institute of Canada was held at the Windsor Hotel, Montreal, P. Q., Canada, on June 9. About 140 members and guests heard a program of papers presented by authors from Canada and the United States. Abstracts of these papers appeared in our May issue, (page 239).

M. F. Anderson, Dominion Rubber Co., Ltd., chairman of the Rubber Division, presided and introduced the speakers. Of special interest were the papers on lignin in GR-S and the papers presented by Canadian technologists from the tire, footwear, and mechanical goods branches of the industry on the comparison of natural and synthetic rubbers for these products. One of the papers, "The Formation and Structure of Vulcanizates," by J. A. Bardwell and C. A. Winkler, of McGill University, appears on page 509.

At the business meeting of the Division the following officers were elected for the year: chairman, H. G. Deline, Dunlop Tire & Rubber Goods Co., Ltd., Toronto, vice chairman, J. Ramsey, Gutta Percha & Rubber Co., Ltd., Toronto; and secretary-treasurer, J. T. Black, Polymer Corp., Sarnia, Ont. Other members of the executive committee are R. B. Marr, Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Montreal; N. W. Smith, Dominion Rubber; and G. D. Stevens, Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont.

The Chemical Institute of Canada will hold its next meeting in Halifax, N. S., in June, 1949. The Rubber Division has not decided as yet whether to meet with the Institute in Halifax or to meet separately elsewhere at about the same time.

## Additional Experimental GR-S Polymers and Latices

ADDITIONS to the list of experimental GR-S dry polymers and GR-S latices, available for distribution to rubber goods manufacturers under the conditions outlined in our November, 1945 issue, page 237, appear in the table which is printed below.

Normally, experimental polymers will be produced only at the request of the consumers, and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside, if possible, for distribution to other interested companies for their evaluation. The 20 bales, when available, will be distributed in quantities of one bale or two bales upon request to the Sales Division of Rubber Reserve, or will be held for six months after the experimental polymer was produced unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received.

| X-Number Designation | Manufacturing Plant | Date of Authorization | Polymer Description | Special Characteristics |
|---|---|---|---|---|
| X-461-GR-S | U. S. Rubber, Naugatuck | | Similar to X-181-GR-S except that the conversion is slightly lower. Normal butadiene - styrene ration. 105 Mooney. | Slightly lower conversion expected to improve solubility characteristics and processing. Also similar to GR-S-85 except for lower conversion. Should show advantages over both X-181 and GR-S-85. |
| X-462-GR-S | U. S. Rubber, Borger | 5-28-48 | A GR-S black masterbatch containing 60 parts of HAF black per 100 parts of GR-S (X-432) made at lower reaction temperatures (40° F.) with cumene hydroperoxide activated recipe. | |
| X-463-GR-S | U. S. Rubber, Borger | 5-24-48 | Standard GR-S monomer charge ratio polymer in an activated recipe, emulsified with special fatty acid soap. Reaction temperature 14°F.; 55-65 Mooney; 1.25% BLE. Salt acid coagulation. | |
| X-464-GR-S | U. S. Rubber, Borger | 5-24-48 | Standard GR-S monomer charge ratio polymer in an activated recipe, emulsified with special fatty acid soap. Reaction temperature 0° F.; 55-65 Mooney; 1.25% BLE. Glue acid coagulation. | |
| X-465-GR-S | U. S. Rubber, Borger | 5-28-48 | A GR-S black masterbatch containing 50 parts of HAF black per 100 parts of GR-S (X-432) made at lower reaction temperatures (41° F.) with cumene hydroperoxide activated recipe. | |

## Low-Temperature Rubber

W. B. REYNOLDS, of the research department of Phillips Petroleum Co., spoke on "Philprene Low-Temperature Rubber" before the June 11 dinner-meeting of the Philadelphia Rubber Group, at Kugler's Restaurant, Philadelphia, Pa., with approximately 100 members and guests attending. Dr. Reynolds stressed the use of X-ray techniques in demonstrating the fundamental differences between low-temperature synthetic rubber and GR-S. By using polybutadiene as a "model" polymer, it can be shown conclusively that low polymerization temperatures increase the structural regularity of the polymer. This increased regularity is felt to be responsible in part for the greatly improved properties of low temperature rubber, the speaker said. Other important differences are a higher number average molecular weight for the low-temperature rubber and lower content of very low molecular weight "soupy" polymer.

The speaker discussed the processes in operation for the production of Philprene A (41° F. rubber) and Philprene B (14° F. anti-freeze rubber) in the company's synthetic rubber pilot-plant at Phillips, Tex., showing flow diagrams of the processes and refrigeration equipment. Physical properties of the Philprenes were discussed, and recent tire tests on Phillips test cars were mentioned. The combination of Philprenes with HAF black (Philblack O) has produced tire treads showing phenomenal wear and extremely high resistance to chipping and cracking, Dr. Reynolds declared.

The Group will hold its annual outing on September 17 at the Oak Terrace Country Club. A full program of golf and other sport contests has been arranged for the enjoyment of those attending.

## 1947 Kaolin Consumption

THE rubber industry took 166,201 tons, or 2% of the kaolin produced domestically in 1947, according to the Bureau of Mines, United States Department of the Interior, Washington, D. C. Kaolin, or China clay, ouput from domestic mines rose to a record of 1,425,106 short tons in 1947, an increase of 8% over 1946 tonnage. The paper industry was the largest consumer of kaolin, using 775,760 tons, followed by the rubber industry. Other important consumers were the refractories industry with 142,449 tons, and the pottery industry with 120,222 tons. The average sales value of kaolin in 1947, as reported by producers, was $12.70 per ton, as compared with $10.84 in 1946. Imports of kaolin decreased from 89,233 tons in 1946 to 82,628 tons in 1947.

# RUBBER WORLD
# NEWS of the MONTH

## Highlights—

**With another 1,000,000-ton rubber consumption year in prospect, the rubber goods manufacturing industry may have to use greater amounts of synthetic and reclaimed rubber if it is to have sufficient raw material to fill all orders during 1948. The present outlook for any improvement in the supply of more and better grades of natural rubber is not good. Synthetic rubber production in the United States, however, can be increased, and the supply of reclaimed rubber is adequate. On the labor front the Firestone and the Goodyear companies have agreed to an 11c-an-hour wage increase for their URWA workers, and this may set a pattern for settlement of the wage increase question for many other companies in the industry.**

## Industry 1948 Outlook Continues to Improve; Less Natural and More Synthetic Rubber Usage Likely

Activities during the past month or six weeks have demonstrated a greater confidence in the business outlook for the rubber goods industry than was thought possible during the first quarter. Tire and tube shipments are at a higher rate; the demand for mechanical goods continues on the increase, and many new products seem likely to develop into large-volume items. In spite of higher production costs, the possibility of earnings approaching those during the year 1947 is now viewed with more optimism.

The natural rubber supply situation, however, appears less favorable than it did a few months ago. Production in Malaya, which was plagued with some labor difficulties earlier in the year, is now confronted with labor trouble of an even more violent nature. Production in Netherlands India, which had achieved a figure of about 30,000 tons a month, may be retarded by the at least temporary breaking off of talks between the Dutch Government and the Republic of Indonesia on the peace settlement. In addition, the quality of natural rubber arriving in the United States continues to decline, and the shortage of the better grades of rubber may become aggravated. Ample synthetic and reclaimed rubber appears available.

### Industry Outlook Good

The general attitude of optimism for a near-record year of production and sale of rubber goods, as mentioned in May, has received further confirmation during June. Favorable comments by market research analysists for various companies on the growing demand for tires and other rubber products for the farm indicate that this field will be a source of an increasing amount of business for at least the next year or two.

Larger-than-anticipated sales of replacement tires and the growth in the sales of non-tire products, which now account for as much as 40% of the total sales of some companies, are factors contributing to the belief that sales and earnings for 1948 may be greater than estimated during the first quarter.

The regular monthly report of The Rubber Manufacturers Association, Inc., stated that tire manufacturers produced 5.2% fewer passenger-car tires in April than in March, but shipped 28.5% more—a total of 5,851,626 casings. Output of truck and bus tires also declined 5%; while shipments rose 3.5%. The rise in shipments is in line with the usual seasonal pattern of tire demand which is higher during the spring and the summer months. Of special significance is the drop in passenger-car tire output which ran counter to the rise in demand and allowed producers to reduce their inventories built up during previous months. Stocks of truck and bus tires continued to rise, however, going up about 1%.

Demand for conveyer belting continues to be tremendous, according to published statements by industry executives. Higher wages, shorter hours, and an urge for improved working conditions with less human lifting in industry are all silent salesmen for hose and belting manufacturers. Demand for V-belts is also growing remarkably for oil-well drilling machinery and diesel locomotive drives.

The report of the United States Department of Commerce on consumption, production, and stocks of rubber according to type for April (preliminary figures) showed consumption as: natural, 50,651 long tons (including 2,051 tons, dry weight, of latex); GR-S, 26,779 tons; neoprene, 2,839 tons; Butyl, 4,540 tons; and nitrile types, 472 tons.

New supply and production for April were: natural, 40,649 tons (including 2,283 tons, dry weight, of latex); GR-S, 33,-968, neoprene, 3,093 tons; Butyl, 3,519 tons; and nitrile types, 266 tons.

Stocks on hand on April 30 were: natural, 123,340 tons (including 8,314 tons, dry weight, of latex); GR-S, 57,445; neoprene, 5,277; Butyl, 13,447; and nitrile types, 2,509 tons.

### RMA Protests Excise Tax

In a brief filed with the House Ways and Means Committee, the Rubber Manufacturers Association asked for tax relief on behalf of the manufacturers of semi-pneumatic tires, molded solid tires, and extruded, wired-on cab-type tiring. This action supplements an earlier appeal for relief from the present high wartime excise tax on automotive tires, which is held by manufacturers to be excessively and disproportionately higher than the levy against other automobile accessories.

At certain levels of sale, automotive tires carry excise taxes running as high as 14%. In its supplemental brief, the Association showed that the tax ranges from 49.3 to 55.7% on baby-carriage types of tiring. Taxes on certain semi-pneumatic toy and lawn-mower tires were shown to range from 26.3 to 35%.

The Association expressed the belief that Congress did not intend to subject these tires to taxation when it made automotive pneumatic tires taxable under the Revenue Act of 1932. Many of the tires in the non-pneumatic class were not even manufactured at that time.

"As essential parts of industrial tools, of toys and of such necessary vehicles as baby carriages and strollers, they are in no sense a luxury," it was said.

### Commerce Industry Advisory Committee Meetings

There were two meetings of the Industry Advisory Committee of the Rubber Division of the Department of Commerce held in Washington, D. C., one on April 23 and the other on May 7. The advice of the Committee on the revision of the Rubber Order R-11 was obtained with special reference to the mandatory consumption requirements for Butyl rubber and the production and the consumption of GR-S in relation to stockpiling.

E. W. Glenn, chief of the Rubber Division, advised the Advisory Committee of the majority recommendation of the Tire & Tube Consulting Technical Committee, which called for the mandatory use of Butyl in all truck and bus tubes 9.00 and down (except 15- and 16-inch diameter) and in approximately 42% of all other tubes.

Some Advisory Committee members took the position that the recommendation of the Consulting Committee should be endorsed; while other members felt that existing specifications should be retained, but with Butyl specified in 9.00 and smaller truck sizes (except 15- and 16-inch) to compensate for the additional tolerance in the popular passenger-size tubes and with 20% tolerance in truck sizes as well.

The reason for the discussion was the fact that present grades of Butyl do not make satisfactory inner tubes for use on drop-center rims in extreme cold areas. It was also pointed out that the cold buckles in Butyl tubes had resulted in many tire failures as well.

Mr. Glenn stated that Public Law 469 imposes upon the Department of Commerce the responsibility of administering the Rubber Order in such a manner that the amounts of synthetic rubber consumed will permit acquisition of natural rubber for stockpiling, as well as maintaining the minimum consumption required by law. This puts the emphasis on stockpiling, rather than allowing stockpiling to be considered as secondary to other needs for rubber. He called attention to the recent International Rubber Study Group statistics which indicate that there may not be enough natural rubber available to the United States in 1948 to meet the full needs of strategic stockpiling and of rubber industry consumption unless the voluntary use of synthetic and reclaimed rubber is increased.

The representative of the reclaimed rubber industry pointed out that there is presently an overcapacity of reclaimed rubber facilities and there is a rather large inventory on hand. He stated that several reclaiming plants are presently operating

[1] See India RUBBER WORLD, June, 1948, P. 390.

on a four-day per week basis and that one new plant had been built, but had never been put into operation because of the overcapacity of reclaim.

The supply and demand aspects of GR-S were reviewed, and attention was called to the fact that government stocks had increased by about 10,000 long tons from December 31, 1947, to March 31, 1948. Walter Munster, of the Office of Rubber Reserve, stated that further increases in government stock were in prospect. This condition is due to the fact that April production of GR-S amounted to approximately 34,000 long tons, with ensuing months scheduled at about 35,000 long tons; while orders for GR-S in the second quarter of 1948 were running under 30,000 long tons a month. These factors, along with still lower consumption estimates for the third and the fourth quarters of 1948, emphasized the need of early expansion of voluntary consumption of GR-S in order to justify the maintenance of present GR-S production levels.

The ORR representative pointed out that if it were decided to program an increased GR-S production, it would take six months to realize full production inasmuch as it would require putting additional monomer facility into operation to produce an additional 4,000 long tons of GR-S a month. It was also brought out that feedstock producers had indicated to ORR that they would not be interested in an expansion of operations unless a contract for approximately two years' operation was consummated.

There was considerable discussion of the statistics developed by the International Rubber Study Group. It was noted that natural rubber consumption estimates for countries outside the United States are on the increase.

#### Other Comments on Rubber Supply

Lockwood's June *Rubber Report* asks why more American firms are not negotiating with the government to lease or purchase synthetic rubber plants. With the relative assurance they have now of a short supply of natural rubber continuing for quite a period, and with the almost certain continued present level of natural rubber prices, it would seem much more the free enterprise way of tackling things to go out and produce GR-S privately rather than to have either increased government production or higher mandatory use, it was said.

Lockwood's *Report* estimates U.S.A. consumption for 1948 at 100,000 tons over the Rubber Study Group figure of 968,000 tons and adds that informed government and industry estimates now considerably exceed 1,000,000 tons.

In the Commerce Department's publication, "Industry Report—Rubber for May," E. G. Holt also calls attention to the fact that rising demand for natural rubber in foreign countries has reduced the supplies available to the United States in recent months. The imports into the United States during the second quarter of 1948 directly from Malaya will be unusually low, and the price of rubber has risen since early March and continues at a level high enough to stimulate the voluntary use of GR-S, he adds.

If strategic stockpiling by the United States Government is to progress, it appears that an increased use of synthetic rubbers will be necessary. Quickest results could be achieved by voluntary use, which permits greatest freedom of action to the individual manufacturer. Company formulae can be changed more rapidly than technicians can agree on mandatory industry specifications, Mr. Holt points out.

Reports in mid-June that the Netherlands Government had broken off negotiations, at least temporarily, with the Republic of Indonesia at Batavia in irritation over premature publication of an American-Australia compromise plan and the rise of an allegedly Communist-organized wave of violence in Malaya, gave further indication that the natural rubber supply from the Far East may be less during the next several months.

The Secretariat of the Rubber Study Group in London, England, issued a press release on the world's rubber position through April, 1948, which was received during the latter part of June and which gave the following information:

WORLD RUBBER POSITION — APRIL, 1948

Natural Rubber

| | April (In Long Tons) | Jan./April |
|---|---|---|
| Production | 127,500 | 475,000 |
| Consumption | 110,000 | 445,000 |
| Stocks end of period | | Change since January 1, 1948 |
| In producing areas | 240,000 | +10,000 |
| In consuming areas | 380,000* | .... |
| Afloat | 212,500 | —27,500 |
| Total | 832,500 | —17,500 |

Synthetic Rubber

| | April | Jan./April |
|---|---|---|
| Production | 45,000 | 178,500 |
| Consumption | 37,500 | 165,000 |
| | | Change since January 1, 1948 |
| Stocks end of period: | 90,000 | +12,500 |

*Excluding such government stocks as are not available to industry.

## Labor-Management Relations

Negotiations which have been going on since early May between the Big Four and some of the other rubber companies and the URWA union in connection with new working conditions contracts and/or wage increases were partially concluded in mid-June with the Firestone Tire & Rubber Co. signing a company-wide working conditions contract and granting an 11c-an-hour wage increase and then similar action being taken by the Goodyear Tire & Rubber Co. The discussion between The B. F. Goodrich Co. and the union, which was broken off on June 5, after which a strike vote was scheduled, was resumed about two weeks later. The other member of the Big Four, United States Rubber Co., began negotiations with the union on June 1.

Meanwhile discussion between The General Tire & Rubber Co. and the URWA was conducted with some interruptions last month.

#### The Firestone and the Goodyear Settlements

The first break in the rather extensive series of negotiations on contracts and wages between the major rubber companies and the URWA came on June 12 with the announcement that the Firestone company had granted an 11c-an-hour wage increase to its 23,000 workers and at the same time had signed a master agreement covering working conditions for employes in all eight plants. The wage increase was announced jointly by the company and the union and became effective June 14 and runs until April 14, 1949. Either side, however, may ask to reopen wage talks on 60 days' notice. The new working conditions contract runs until March 1, 1950.

The Firestone wage increase is a straight hourly increase and does not include an escalator clause with a cost-of-living formula, as does the recent contract signed by General Motors Corp. and the United Automobile Workers union. The Firestone company-wide master contract covers check-off, vacation program, seniority, severance pay, holiday pay, overtime provisions, and arbitration procedures, among other things.

L. S. Buckmaster, URWA president, in commenting on the Firestone increase, said that the 11c-an-hour raise does not compensate the worker for the increase in the cost of living in the past two years, but it was his belief that such an increase would avoid any increase in prices and would help bring some measure of stability to our economy. He commended the company for its cooperation in reaching the wage settlement and the first company-wide contract with the Firestone organization.

The increase boosts average hourly earnings of 12,500 Akron, O., Firestone workers from $1.62 to $1.73. Average pay for workers in all eight Firestone plants, including Akron, is increased from $1.57 to $1.68 an hour. The company estimated that the increase would cost $4,762,000 annually.

The Goodyear settlement, also effective June 14, and granting a similar 11c-an-hour wage increase, was announced on June 17. The company-wide working conditions contract between the company and the URWA, which expired on June 1, was extended until February 10, 1950. The wage issue may be reopened after one year on 60 days' notice. A provision for three week's vacation with pay after 15 years' service is included in the new contract.

The wage increase will cost the Goodyear company more than $7,000,000 annually, according to company officials. Should comparable increases be allowed non-union employes, payrolls will be increased to a total of approximately $11,000,000 a year. In addition, the liberalized vacation plan will add about $500,000 more to the annual payroll; while a contract provision for service awards is expected to add a similar amount.

#### The Goodrich Negotiations

Wage negotiations between the Goodrich company and the URWA were broken off in Philadelphia, Pa., on June 5. The company was reported to have offered an 8c-an-hour increase, which was rejected by the union. The union had agreed to settle for a 15c-an-hour wage increase and a contract to run for one year, or an 11c-an-hour increase and a contract with an escalator clause similar to that signed by General Motors and the UAW. A strike vote was then called by the URWA local union in Akron, and on June 16 it was reported that 7,500 workers voted overwhelmingly in favor of a strike.

On June 26, Goodrich issued a special bulletin with regard to negotiations with the URWA. This bulletin stated that negotiations were completed on June 25 with an agreement which provides for an 11c-an-hour increase in individual rates and for an adjustment in incentive base rates to provide an 11c-an-hour increase on averages. The increase is effective as of June 21, 1948. Three weeks' vacation are provided all employes who have 15 or

more years of service. The new agreement extends the expiration date of the September 6, 1947, agreement from November 15, 1948 to June 25, 1949. Wage levels are frozen for the agreement's duration.

During the negotiations the company pointed out that earnings of Goodrich employes in URWA plants are higher than earnings of 94.5% of the 19,000,000 workers employed in American manufacturing, mining, and distribution.

In addition the company directed attention to the large additional employment cost it bears in providing paid vacations, pay for holidays not worked, old age taxes, unemployment insurance taxes, Workmen's Compensation, and for employe benefit programs which are among the most liberal provided in American industry. Employe benefit programs include the retirement program, life insurance, hospitalization and surgical insurance, disability insurance, and severance pay. The cost of these benefits in 1948 is at the rate of 16¼c an hour of work exclusive of providing the third week of vacation. The Goodrich retirement program, which will approximate $3,000,000 in 1948 for all employes, is reflected in this extra cost. Providing a third week of vacation for 15-year service employes will add another $400,000 a year, it was said.

Attention of every member of management is directed to the increased responsibility which these increased employment costs will bring in necessitating the use of every method to improve manhour productivity and efficiency. The highly competitive position of the rubber industry requires that costs be kept at their lowest possible figure and quality be maintained at its high level, the bulletin concluded.

### U. S. Rubber Settlement

On July 2, U. S. Rubber and the URWA union also issued a statement to the effect that a contract had been signed providing for an 11c-an-hour wage increase, effective June 28, for 35,000 employes, and three weeks' vacation with pay for employes having 15 years of service. The agreement will continue in effect until July 1, 1950, and contains a provision permitting reopening of wage negotiations upon 60-day notice, after May 1, 1949. The contract embodies provisions for voluntary checkoff of membership dues, grievance procedure and arbitration, overtime pay, severance pay, and other matters generally covered by collective bargaining agreements. The company estimated the annual increase at more than $11,000,000.

### Other Labor News

Contract talks between General Tire and the union were also held last month.

A strike, which began May 8 at the plant of the Sun Rubber Co. in Barberton, O., had not been settled as yet in late June. The main items of the dispute are the union shop and severance pay. This dispute was aired in the editorial and advertising columns of the *Akron Beacon Journal*. The company offered maintenance of membership and check-off, but the union insists on a union shop. Local 58 of the URWA is involved in this dispute.

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**Pequanoc Rubber Co.,** Butler, N. J., last month announced that Miss M. T. Gunter has resigned as secretary-treasurer, effective July 1, after 47 years of service. She joined the company in 1901 when it was formed by the late Joseph F. McLean. Miss Gunter, an authority on accounting and tax problems, will continue to serve as a director.

# EASTERN AND SOUTHERN

J. Scheuermann

Ross Mekeel and Tom Carter

## Cameron Personnel Changes

At the last quarterly meeting of the board of directors of the Cameron Machine Co., 61 Poplar St., Brooklyn 2, N. Y., J. Scheuermann was elected vice president of the Brooklyn concern and also vice president of Cameron Machine Co. of Canada, Ltd. Mr. Scheuermann is also sales manager of the company.

At the same meeting, Ross Mekeel was elected secretary. Mr. Mekeel has served for many years as purchasing agent and will continue in that capacity.

Mr. Donnelly, formerly chief engineer has resigned from the company. Tom Carter, formerly of the new design department, now becomes manager of the engineering department.

R. W. Cummings has resigned as secretary of the company and after a three-month vacation will return to act as sales representative in the southern states.

E. J. Ward will take over Mr. Cummings' previous duties as service manager.

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**Frank W. Lovejoy,** sales executive of Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y. recently was elected vice president of the New York Sales Managers' Club.

**Stauffer Chemical Co.,** 420 Lexington Ave., New York, N. Y., has added to its sales staff Harry J. Miller, formerly with Goodyear Tire & Rubber Co. Mr. Miller maintains headquarters in Akron, O.

**The Glenn L. Martin Co.,** Baltimore, Md., has appointed Eleanor Fisher Horsey to the staff of its chemicals division. She will prepare technical reports and other written materials for customer information and industrial distribution on Marvinol VR-10 and other chemical products of the company.

**Koppers Co., Inc.,** Pittsburgh, Pa., has appointed Charles F. Hosford, Jr., former president of Pennsylvania Coal Products Co., Petrolia, Pa., West Coast manager of the Koppers chemical division, with headquarters in San Francisco, Calif. Mr. Hosford came to Koppers early last year after it had purchased Pennsylvania Coal Products and made it an integral part of the chemical division.

Fred C. Foy, vice president of J. Walter Thompson Co., has accepted an appointment as vice president and manager of the sales department, central staff, of Koppers Co., Inc. He will be responsible for the coordination of sales activities of the company and the development of sales policies, methods, organization and distribution systems on a company-wide basis, dealing with all products of all company divisions. He also will be responsible for general economics forecasts and analyses of markets.

The appointment of Mr. Foy fills a vacancy created last April 1 when E. J. McGehee, vice president and sales manager of Koppers, was assigned responsibility for the company's wood preserving activities in the western half of the United States.

Ralph Winslow, Koppers' director of public relations, who has been serving as acting manager of the sales department, will continue to guide activities of both departments until Mr. Foy takes up his new duties on August 1.

**E. I. du Pont de Nemours & Co., Inc.,** Wilmington, Del., has announced that Edmund G. Robinson, general manager of the organic chemicals department since 1929, retired from active company service July 1. He is succeeded by John E. Daley, general manager of the company's pigments department. Mr. Robinson will continue, however, as a member of the du Pont company's board of directors.

Ludox colloidal silica is now being produced by du Pont in full-scale commercial quantities. A new unit to manufacture this material has been completed at the East Chicago, Ind., works of the Grasselli chemicals department, and deliveries can now be made in any desired quantities. When first announced by du Pont last October, Ludox was available only on a small scale in 18% silica concentrations. As a result of further research and development, stable solutions with a concentration of 30% are now being produced. This higher concentration permits substantial reductions in shipping costs and simplifies storage problems. The effectiveness of Ludox in modifying products made of natural or synthetic rubber latex has already been established. It strengthens elastic thread and the bonds of adhesives and cements of various types. Other uses for Ludox include weave-setting treatments for rayon fabrics and other textile applications and also as a modifier for many types of aqueous solutions and emulsions.

## New Quarters for Rodic

John H. White, Jr., vice president and general manager of the Rodic Rubber Corp., New Brunswick, N. J., has announced that the major portion of the company's business is being carried on in its new building on Allen Ave., New Brunswick. This modern plant contains 65,000 square feet of floor space. The firm's other factory, at Garwood, N. J., contains 10,000 square feet of floor space.

Latest equipment installed includes two 30-foot vulcanizers, new high-pressure molding presses, high-speed mixing equipment—including a Banbury, conveyers, and a compound room, in addition to a modern laboratory.

The Rodic corporation was founded in 1925 by Charles T. Dickey in Garwood to make mechanical rubber products. Mr. Dickey, a pioneer in New Jersey's rubber industry, started his career in 1902. His first production consisted of platens and feed rolls for business machines, turned out in a small building which housed both the office and the plant. As business increased and new lines were added, such as industrial items, molded goods and extrusions, more space was required; so a second building was obtained in 1935; and a third in 1938.

With the outbreak of the war in 1941, production was quickly converted to war material, and the laboratory staff was enlarged to meet severe war specifications and to train personnel in the handling of synthetics.

Meanwhile the company pioneered in the production of plastic hose and soling, and the laboratory staff cooperated in the development of specifications and formulations for compounds designed to withstand extremes in temperatures and resistance to solvents.

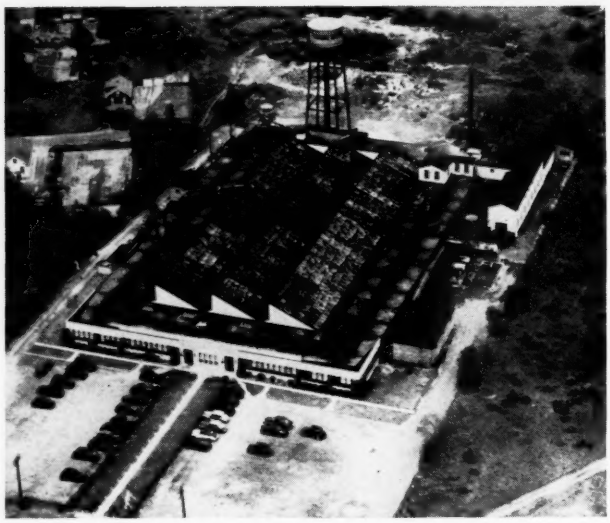
Today Rodic production includes platens and parts for business machines, industrial rolls, extrusions, and molded mechanical goods, including bonded assemblies.

Other company officers are J. J. Brooks, president; L. Edland, vice president and sales manager; W. J. Carson, treasurer; R. S. Phillips, purchasing agent; and Lester Riefenstahl, chief chemist.

**The Thermoid Co.**, Trenton, N. J., at a recent board meeting elected Carl Brockway to a vice presidency. Prior to becoming associated with Thermoid in 1941, Mr. Brockway had been president and general manager of Worldbestos Corp., a brake lining manufacturing concern. In his new capacity Mr. Brockway will be responsible for all production of brake lining, clutch facings, and other friction materials.

Thermoid also recently announced several changes among its sales personnel. Chet A. Leas, factory sales engineer at Trenton, has been made territory sales representative for southern Texas, with headquarters in San Antonio; while L. A. Mocarsky, of the automotive replacement sales division, has been sent to the Philadelphia area. E. C. McGinley, who formerly covered the Akron area, is now stationed at the Pittsburgh division, and E. C. Hankemeier has moved to Thermoid headquarters in Denver, Colo.

**General Aniline & Film Corp.**, 247 Park Ave., New York, N. Y., recently elected Horace C. Flanigan a director. He is also vice chairman of the board of the Manufacturers Trust Co. and on the directorates of many other corporations.



**Plant of Rodic Rubber Corp. at New Brunswick, N. J.**

**A. Schrader's Son Division**, Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn 17, N. Y., has announced the new Pressur-tel valve cap as an aid to the low-pressure tire program and to help promote correct inflation for all tires. The correct pressure for the tire is stamped right on top of the Pressur-tel cap in numbers approximately $\frac{1}{4}$-inch high. All the service attendant or motorist has to do is glance at the number on the cap and inflate the tire accordingly. The new cap will be packed in attractive merchandising display packages for sale through retail outlets. As soon as packaging arrangements are completed, the cap will be released for general distribution to the tire and automotive trade.

**The Irvington Varnish & Insulator Co.**, Irvington, N. J., has appointed Willis J. Stillwell vice president. Mr. Stillwell joined the company in 1942 as manager of the reports analysis department, later became general auditor, and in April, 1945, assistant to the president.

John W. Apgar, sales manager of the Irvington Varnish coating division, has been named assistant to the general manager of the division; while Donald May, sales service manager of the division, succeeds Mr. Apgar as division sales manager.

Irvington Varnish also has made Robert E. Jones a vice president and general manager of the cap seal division. With the company since 1934, he was appointed assistant treasurer in 1940.

**C. J. Osborn Co.**, manufacturer of synthetic resins, pigments, and dispersed pigments, 132 Nassau St., New York 7, N. Y., through Sales Manager W. F. Purdy has announced that D. H. Ezell has joined the company in a technical sales capacity. He will make his headquarters at the company's laboratories on the plant site in Linden, N. J., and will be in charge of technical service and product application research in the protective coatings field. Mr. Ezell brings to his new position 15 years' experience in the coatings industry. This addition to the firm's technical resources is consistent with the expansion program initiated by the recent construction of a new laboratory building.

**Woburn Chemical Corp. (N. J.)**, 1200 Harrison Ave., Harrison, N. J., has announced the appointment of Everett E. Price to the directorates of Woburn Chemical and Woburn Degreasing Co., Woburn, Mass. Mr. Price first entered the employ of Woburn Chemical in 1935 as assistant treasurer and was made treasurer in 1942.

**L. A. Dreyfus Co.**, Rosebank, S. I. 5, N. Y., is moving its offices and laboratories to larger quarters in its new plant nearing completion at One Park Ave., Oak Tree, N. J. Mail should be addressed to P. O. Box 500, South Plainfield, N. J.

**Johns-Manville Corp.**, 22 E. 40th St., New York 16, N. Y., has announced that six employes, including Simon Collier, director of quality control, were inducted into the Johns-Manville Quarter Century Club, a company organization honoring those with 25 years' active service, at a luncheon meeting on May 26 at the Builders Exchange. Lewis H. Brown, company chairman of the board, officiated at the ceremony and presented Mr. Collier and the other inductees with a gold watch and pin emblematic of their membership in the club.

**American Enka Corp.**, New York, N. Y., began full-scale operations at its new $26,000,000 rayon plant at Morristown, Tenn., early in June. One of the largest industrial plants constructed in the United States since the end of the war, the new plant will employ more than 1,000 persons and will manufacture about 20,000,000 pounds of rayon tire yarn annually. Design work for the plant began late in 1946 and actual construction at the 20-acre plant site started about 18 months ago.

**Webber & Smith, Inc.**, 52 Vanderbilt Ave., New York, N. Y., was dissolved as of June 1, 1948, and the business will be conducted by Robert J. Webber as an individual, under the name of Robert J. Webber Co., at the same address, representing Evans Lead Corp., Thompson-Weinman & Co., and the Chemical Products Corp.

## Van der Velde Visits U.S.A.

Recent reports of increasing production of rubber and other commodities in Netherlands India were confirmed by Jan van der Velde, special political adviser to Lieutenant-Governor General van Mook and a leading expert on Sumatra, at a luncheon in his honor at Pierre Restaurant, New York, N. Y., June 23. Dr. van der Velde, who left the Far East a few months ago, expects rubber production from Northern Sumatra estates to reach 80,000 tons this year.

Discussing wartime damages sustained by estate factories, he revealed that there was a tendency, where possible, for several estates whose factories had been damaged to send their latex for further preparation to a neighboring estate where the factory was in working order. As to American estates, some of the largest had escaped major damages.

Native rubber growers are becoming increasingly active; the district of Palembang in Southern Sumatra now exports at the rate of 3,500 tons a month, Dr. van der Velde said. The monthly average exports were about 2,700 tons in 1939 (the exports for the year totaled 32,456 tons); at the restriction rate then prevailing these 1939 exports averaged only 58¾% of standard production; nevertheless they represented a substantial increase over those of preceding years. In Djambi, too, natives are, on the whole, anxious to get back to producing rubber.

Dr. van der Velde was accompanied by Leendert Korthals, advisor of the Netherlands Trade Commission, who left Java some months ago. Both were anxious to make it clear that improvement in the political situation in Netherlands India depends on improved economical conditions of the country to achieve which, the natives must be willing to work to help bring out the great wealth of the country; and to insure their willingness it is necessary to make food and incentive goods, especially textiles, readily available to them. This policy requires financial assistance, which it is hoped to obtain from the United States Government.

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**Johnson & Johnson,** New Brunswick, N. J., has appointed John F. Kiley manager of general line sales. Mr. Kiley, who joined the company in 1934 as a salesman, most recently had been serving as acting manager of general line sales.

**Raybestos-Manhattan, Inc.,** Passaic, N. J., has made Littleton C. Barkley general sales manager, asbestos and rubber products, West Coast division, where he will supervise sales of the Manhattan Rubber, Asbestos Textile and Packing and Equipment Sales divisions of the corporation. Mr. Barkley, with Manhattan Rubber Division 23 years, until recently had been the division's sales manager for mechanical rubber goods.

John H. Matthews, vice president and director of Raybestos-Manhattan, was elected to the board of directors of the Canadian Raybestos Co., Ltd., at the recent annual meeting at Peterborough, Ont., Canada. The company makes automotive friction material and rubber and asbestos products for the Canadian market and is an operating unit of Raybestos-Manhattan. Mr. Matthews is in charge of the Manhattan Rubber Division and has been with Manhattan since 1914.

## News from U. S. Rubber

United States Rubber Co., Rockefeller Center, New York 20, N. Y., on June 13 announced it is this year again offering the graduate fellowships in chemistry established at ten leading universities in 1947 and is also establishing a graduate fellowship in physics at University of Virginia. Universities which have accepted the fellowships in chemistry are: California Institute of Technology, Cornell University, Harvard University, Massachusetts Institute of Technology, Northwestern University, University of California, University of California at Los Angeles, University of Chicago, University of Minnesota, and University of Wisconsin. The fellowships will be available for the academic year starting July 1, 1948. Under terms suggested by the rubber company, each of the ten who receive fellowships in chemistry will be provided with $2,200 a year if single, or $2,800 if married, of which $1,000 will go to the university to cover tuition and other costs. The recipient of the fellowship in physics at University of Virginia will receive $1,500.

A temporary manufacturing plant of the company in Newport, R. I., has been closed. The plant was opened in 1946, when additional workers could not be obtained at the company's main plant in Providence. Operations performed at Newport included winding golf balls and trimming heels. At the peak of production the number of employes totaled 90. More recently this number had been reduced to 19. Machinery is being transferred back to the main plant at Providence, where operations are being consolidated for more efficient operation.

U. S. Tires division has established a Midwest divisional office with headquarters at Kansas City, Mo., according to J. C. Ray, sales manager. The new office will supervise sales of U. S. Royal Tires in the Dallas, Des Moines, Minneapolis, Oklahoma City, Omaha, and Kansas City districts which comprise the new divisional territory.

John Griffin, formerly district manager at Kansas City, has been appointed divisional manager. Mr. Griffin joined U. S. Rubber in 1929 at Los Angeles as assistant district manager, was made district manager at Seattle in 1932, and subsequently served in similar capacities at Omaha and Minneapolis.

William J. Miller, formerly assistant district manager at Kansas City, has been appointed district manager there, succeeding Mr. Griffin. Mr. Miller came to the rubber company in 1935 as a tire adjuster and was later transferred to the Detroit plant as project engineer in war activities production. He served in the Navy during the war and returned to the company in 1946 as salesman in the Kansas City district.

S. A. Hendrickson has been appointed Buffalo, N. Y., district manager for the division. Mr. Hendrickson succeeds F. S. Guisewite, who resigned to enter into business for himself.

The company on July 2 appointed Jack Suttie special grinding wheel representative for the Midwest and Southwest. Mr. Suttie became associated with U. S. Rubber in 1941 after a 10-year career in the steel foundry industry.

Synthetic rubber produced at low temperatures "looms as the most important development in synthetic rubber research since GR-S, the original general purpose synthetic, was put into production," according to a statement by Herbert E. Smith, president of U. S. Rubber. "If continued tests prove the new synthetic is as good as it now promises to be, this nation will be much less dependent on importation of natural rubber," Mr. Smith said. "Also, the day is brought closer when synthetic rubber will be able to stand on its own feet economically without government support."

Tests to date indicate that the new synthetic, developed by the rubber, chemical, and petroleum industries under the direction of Rubber Reserve, gives tire treads that outwear the best natural rubber treads by as much as 30%. The new rubber is being produced in limited quantities at government plants operated by U. S. Rubber at Borger, Tex., and by Copolymer Corp. at Baton Rouge, La.

A discussion of the development and importance of low-temperature synthetic rubber was also given by S. M. Cadwell, director of research and development for U. S. Rubber, at a meeting of the Detroit Rotary Club on June 2. The new rubber is being produced at 41° F., instead of the standard temperature of 122° F. for regular GR-S, and laboratory batches of rubber made at still lower temperatures have been made and tested. Dr. Caldwell also stated that methods have been worked out for plant production of synthetic rubber at temperatures as low as 14 and 0° F.

According to Arthur W. Bull, director of tire development for U. S. Rubber, the new synthetic rubber shows major improvements in tensile strength and crack resistance over standard GR-S, in addition to its superior abrasion resistance.

The rubber company also is now putting nylon on the smallest electrical wire ever developed for wiring homes, offices, factories, hotels, and other buildings. The nylon forms a hard shell over the rubber insulation and provides added protection. The new wire is 30% smaller in diameter than conventional building wire and permits the use of additional wires in a conduit. Under the nylon are two layers of insulation consisting of natural and neoprene rubber. The nylon is applied in a molten state and cools to give a smooth and extremely hard protective shell. The new wire is said to be resistant to gasoline, oil, fire, moisture, acids, and light. It will be marketed under the name Neolay Type RU in conductor sizes 14, 12, 10, 8, and 6.

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**Lee Rubber & Tire Corp.,** Conshohocken, Pa., and subsidiary. Six months ended April 30: net profit, $923,040, equal to $3.64 each on 253,584 capital shares, against $1,391,636, or $5.76 each on 241,509 shares, a year earlier; net sales, $16,665,913, against $19,278,294; reserve for income taxes, $652,000, against $990,000.

The appointment of Richard H. Simons as Pacific Coast factory representative for Lee Tire was also announced in June. Mr. Simons will make his headquarters in Los Angeles, Calif.

**Hewitt Rubber Division,** Hewitt-Robins, Inc., Buffalo, N. Y., has named Charles W. Mackett to the newly established position of manager of sales operations. Mr. Mackett was formerly assistant sales manager of the division which manufactures mechanical rubber goods at one of the Hewitt-Robins' two Buffalo plants. Mr. Mackett joined the company in Chicago, 32 years ago and has since served in various sales capacities. In his new post he will direct all home office sales of the Division.

# OHIO

## Goodyear Advances Several

C. B. Householder has been named to the new position as manager of the fuel tank department for the Goodyear Tire & Rubber Co., Akron, it was announced last month by R. W. Richardson, manager of the aviation products division. This appointment originates a series of major changes in the division, because Mr. Householder was formerly a sales engineer responsible for all Goodyear contacts with airlines in the eastern part of the United States. He will be succeeded in this job by E. M. Humphrey, transferred from the New York office of the aviation products division. He, in turn, will be replaced by W. A. Carlson, who leaves the aviation products office in Miami. G. R. Price, Akron staffman, succeeds Mr. Carlson in Miami.

Appointment of Richard A. Jay as plant manager of the Goodyear Tire & Rubber Co. factory at Lincoln, Neb., has been announced by W. S. Wolfe, factory manager. Mr. Jay replaces Fred R. Shaw, plant manager there since the plant's opening in 1946, who has been assigned other duties. Mr. Jay attended Iowa State College, where he was graduated with a degree in chemical engineering. He joined Goodyear in 1939 as a member of the company's production squadron at the Jackson, Mich., plant, and the following year was transferred to Akron, where he became supervisor in mechanical goods production. He entered the Navy in February, 1943, served until June, 1946, then returned to his former position at Goodyear. Later he was on special assignment out of the factory manager's office.

W. T. Clayton has been appointed plant manager of Goodyear Tire & Rubber Co.'s factory in Norrkoping, Sweden, succeeding John J. Hoesly, who has been in Sweden since the Goodyear factory was opened in 1938—first as development manager and then as plant manager since 1942. Mr. Hoesly will return to Akron for reassignment.

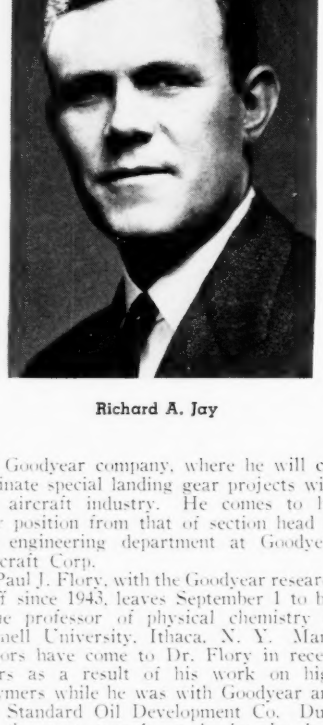
Mr. Clayton's most recent post was plant manager of Goodyear's Wingfoot Homes factory at East St. Louis, Ill. This operation was closed recently. Previously he had been personnel manager of Goodyear Aircraft Corp., in Akron, and during the war held a similar position at Litchfield Park, Ariz., where the company operated an aircraft plant for the government. He has been with Goodyear since 1923.

Edwin M. Eickmann has been appointed manager of Goodyear Tire & Rubber Co.'s South American division. Mr. Eickmann, manager of Goodyear Export's aeronautical sales department since March, 1946, is succeeded by Thomas C. Wallace, who returned to Akron recently after serving in Latin America as the company's special aeronautical representative. Both men will headquarter in Akron.

Mr. Eickmann joined Goodyear in 1929, was pilot of a Goodyear blimp for several years, transferring to sales work in 1934. During the war he was manager of field service for Goodyear Aircraft Corp.

Mr. Wallace came to Goodyear two years ago. A licensed pilot since 1937, he flew two years with the RAF early in the war and then served four years with the U. S. air force.

J. E. Wells has been named a sales engineer in the aviation products division of the Goodyear company, where he will coordinate special landing gear projects with the aircraft industry. He comes to his new position from that of section head in the engineering department at Goodyear Aircraft Corp.



Richard A. Jay

Paul J. Flory, with the Goodyear research staff since 1943, leaves September 1 to become professor of physical chemistry at Cornell University, Ithaca, N. Y. Many honors have come to Dr. Flory in recent years as a result of his work on high polymers while he was with Goodyear and the Standard Oil Development Co. During the past several months he also held the Baker Lectureship at Cornell, the first industrial chemist in this post.

Norman Rabjohn, also of the Goodyear research department, has resigned effective September 1, to become associate professor of organic chemistry at the University of Missouri.

The problem of transporting a full-size swimming pool from one city to another every week for 10 weeks was solved by Goodyear rubberized fabric experts. The new swim show, "Aqua Parade of 1948," managed by Hollywood swimming star, Buster Crabbe, needed two tanks in which selected swimmers and divers could present a modern, water-borne stage show. Relying on wartime experiences in building Navy training pools, Goodyear engineers designed a 98,000-gallon swim tank and a 25,000-gallon diving tank that could be erected in three hours and taken down in even less time. For the swimming tank a synthetic rubber coated nylon liner 54 by 84 feet was built which, when placed within special metal retaining walls, forms a rectangular pool 42 feet wide, 72 feet long, and four feet deep. For the circular diving tank a special nylon liner was tailored to fit with a metal retaining form 25 feet in diameter and eight feet deep.

Two new sizes of premium bicycle tires, the 20-2.125 and 24-2.125 Double Eagle, have been added to Goodyear's line. The 20-inch unit is designed primarily for use on front wheels of cycle trucks requiring tires of exceptionally sturdy construction; while the 24-inch tire is particularly suited for special vehicles, such as pushcarts, often subjected to rough usage and heavy loads. The 24-inch size is also being used extensively on motor-bikes—rebuilt by bicycle shops from conventional models. The new tires round out the company's Double Eagle line, previously manufactured in the 26-inch size.

**B. F. Goodrich Chemical Co.,** 324 Rose Bldg., Cleveland 15, has announced several changes in its advertising department. George B. Koch has been made advertising and sales promotion manager. He has handled publicity since joining the company in early 1946. John F. Moriarty, who formerly directed advertising production, has been named to handle publicity; while John F. Amos has been appointed to handle technical writing. He comes to the advertising department from the company's technical service laboratory. These new appointments are a result of H. W. Brinkerhoff, former advertising manager, and J. L. Whiteman, former sales promotion manager, leaving the company to enter the publishing business in Cleveland.

**Emery Industries, Inc.,** Cincinnati, through Vice President A. W. Schubert, simultaneously announced the addition of new operating units to its plasticizer plant and the availability of a new plasticizer, Plastolein 9715. The company's production facilities have been enlarged twice this year in order to handle increased demand for the Plastoleins, according to J. D. Faiella, Plastolein sales manager. The new product, Plastolein 9715, is described as a resinous plasticizer especially suitable for the vinyls where low volatility and low oil extraction are of major importance. The material, now available in commercial quantities, has also been found to be especially effective in polyvinyl acetate formulations, Mr. Faiella said.

**Firestone Tire & Rubber Co.,** Akron, has developed a new white sidewall bicycle tire with rayon cord. This "new look" tire is said to be the first bicycle tire to incorporate the advantages of greater strength, cooler running, and added protection against blowouts provided by rayon tire cord fabric. Tests of the new tire reveal it to have twice the strength to resist impacts and bruises and double the mileage life of bicycle tires made with conventional fabrics.

Velon film is now being made available to converters in decorator-designed, richly textured yard goods with a three-dimensional effect for draperies and furniture covers, it was announced by Roger S. Firestone, president of Firestone Plastics Co., Akron. This innovation was made possible by the development of new embossing techniques and color printing methods. Color styled and designed in a wide variety of traditional and advanced patterns, according to the converters' specifications, the new-type film will be offered in three textures adaptable to a wide range of application. The new textured Velon had its first showing at the 1948 National Housewares Show, in Atlantic City, N. J., during the last week of May.

**J. P. Seiberling,** president of Seiberling Rubber Co., Akron, was elected to Princeton University's board of trustees at the annual commencement meeting of the Princeton national alumni association in June. A Princeton graduate in 1921, Mr. Seiberling will serve a four-year term as alumni trustee-at-large.

**E. E. Laughlin,** chief chemist of the Pharis Tire & Rubber Co., Newark, leaves September 1 to take charge of all technical work for the F.A.T.E. Co., Roque Perez 365, Buenos Aires, Argentina.

**The Timken Roller Bearing Co.,** Canton O., has announced that a new $200,000 water conservation system began operating last month to insure its plants the 7,200,000 gallons of water they need daily for operation. The system, consisting of a new two-acre, 10,000,000-gallon reservoir and a 25-foot high, 60-foot long, and 30-foot wide cooling tower made of red wood on a concrete foundation, also saves more than 6,000,000 gallons a day of local underground water supply. Prompted by a deficiency in the rainfall since 1938, Timken began construction of its reservoir and cooling tower early in 1947. Both were ready for operation by June 14. Timken uses Canton city water only for drinking and emergency purposes.

**Stabelan Co.,** Toledo, through President Frank W. Baker, has announced the appointment of Harwick Standard Chemical Co., Akron, as national distributer for its line of Stabelan stabilizers for polyvinyl choride resins and copolymers. Three types of stabilizers will be marketed by Harwick Standard: Stabelan Type A for improving the aging qualities of vinyl resins in sunlight; Stabelan Type XL for stabilizing action in high-temperature processing as well as for ultra-violet and sunlight aging; and Stabelan Type G for use with organic reds in addition to stabilizing action under ultra-violet and sunlight and for perfecting film clarities.

According to Mr. Baker, Stabelan accomplishes its stabilizing action on polyvinyl halides and their copolymers by basic improvement of the resins and by its ability to retard decomposition of the resins under prolonged heat and sunlight aging.

**U. S. Stoneware Co.,** Akron, through month by Willis F. Avery company sec- Howard Farkas, vice president and general sales manager has announced the appointment of Russell C. Fancher as sales representative in the Detroit area. Mr. Fancher will work out of the company's newly opened office at 6432 Cass Ave., Detroit, Mich.

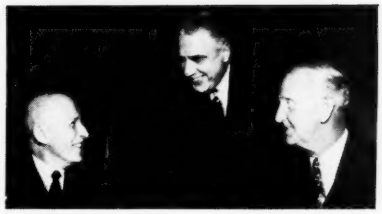
## Changes at Goodrich

J. E. Carter, federal tax counsel for The B. F. Goodrich Co., Akron, has been named assistant secretary, it was announced last month by Willis F. Avery, company secretary. Mr. Carter joined Goodrich in 1929 in the controller's division, later headed a group of accounting departments, and was supervisor of budgets before entering the legal department in 1943. He is a graduate of Dartmouth College in 1920 and was admitted to the Bar of the State of Ohio in 1925.

Wade Ruble, an employe counsellor in the employe services department for the past year, has been named Goodrich employment manager to succeed the late A. C. Sprague.

A total of 13,489 suggestions from employes were received during the two-month "Wipe Out Waste" campaign recently concluded by the Goodrich company among all units of its nation-wide organization. Three prizes of $500 United States savings bonds, with federal withholding and social security taxes also paid will be awarded to individuals whose suggestions during the campaign period have been judged most valuable. A large number of merchandise awards also will be made.

Alberto Pirelli, one of Europe's leading industrialists and head of Italy's largest rubber company, was a recent visitor to Akron and the Goodrich company. John L. Collyer, Goodrich president, was host at a dinner honoring Signor Pirelli. The Italian manufacturer first visited Akron and Goodrich nearly 40 years ago.



**Alberto Pirelli *(Left)*; W. C. Gulick, President, International B. F. Goodrich Co.; and John L. Collyer**

John L. Collyer has joined the Industries Advisory Committee of The Advertising Council, according to Charles E. Wilson, chairman of the Committee and president of General Electric Co. As a member of the Committee, which is composed of 36 top-flight business leaders, Mr. Collyer will represent the rubber industry.

# NEW ENGLAND

## Donald C. Chase Promoted

The appointment of Donald C. Chase to the managership of rubber and plastics machinery sales was announced last month by Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Chase joined the company in 1940 as assistant to W. A. Gordon, inventor of the Gordon plasticator. Mr. Chase has had a wide experience in the design and operation of extruding machines as well as other types of rubber and plastics processing machinery. Prior to his present appointment he was assistant manager of the rubber and plastics machinery sales division. Mr. Chase previously had been employed by Kelly-Springfield Tire Co., where he worked in various engineering and managerial capacities for several years following his graduation from the Massachusetts Institute of Technology in 1926.

**Donald C. Chase**

Simultaneous with his promotion, Mr. Chase was sent abroad to make a survey of customer requirements and equipment developments in England and several European countries. He was accompanied by Alexander Smith, Farrel-Birmingham's assistant chief engineer.

Fernley H. Banbury was awarded an honorary degree of doctor of engineering at Purdue University on June 13. A graduate of Purdue, in the Class of 1900, Mr. Banbury received this recognition for having attained international prominence in industry as the inventor of the Banbury mixer. Although retired since 1943 as head of Farrel-Birmingham's Banbury mixer department, Mr. Banbury still remains active in the capacity of consulting engineer and as a director.

**Armstrong Rubber Co.,** West Haven 16, Conn., is producing a new and improved type of camelback, Armstrong Perma-Bond, containing several unusual features. The camelback uses Ultipara rubber, the new low-temperature rubber made by Copolymer Corp., which in tests has given up to 20% more mileage than the finest natural rubber. Compounded with this rubber is an improved fine-particle furnace black that mixes more thoroughly, gives a finer grain stock, and produces tougher rubber. Other features claimed for Perma-Bond are that it flows more evenly in the mold, handles easily, and gives greater adhesion between the tread and tire carcass. Perma-Bond for truck tires will be made of natural rubber also compounded with the new furnace black. Poly-Ethylene backing is used to provide an airtight coating on the back of Perma-Bond, keeping the surface fresh and tacky, and each roll of camelback is sealed in a Poly-Ethylene bag and is then packaged in a cardboard box.

## G-E Appointments

General Electric Co., Pittsfield, Mass., has appointed Roger W. Jackson sales manager of the chemical department's East Central district, with headquarters in Cleveland, O. Mr. Jackson takes his new post after more than three years as district representative at the Pittsburgh, Pa., office.

General Electric also announced two appointments at its laminated plastics plant in Coshocton, O.

George Alexander has been made assistant to the manager of the plant, in charge of the Coshocton Works' new varnish plant. An employe of the company since 1930, Mr. Alexander was a development chemist in the plastics division laboratory in Pittsfield for seven years. In 1937 he transferred to the laminated products division at Lynn, Mass., and in 1942 became division materials engineer. Appointed assistant divisional engineer in 1945, Mr. Alexander was named works engineer at Coshocton in 1946.

Edward G. Gray succeeds Mr. Alexander as works engineer at Coshocton. Mr. Gray, with General Electric since 1925, joined the plastics division in 1928 as Cleveland sales representative. In 1945 he was named sales manager of laminated products and in 1947 became commercial engineer of laminated products with headquarters in Coshocton.

**General Latex & Chemical Corp.,** 600 Main St., Cambridge 39, Mass., has announced that E. Charlton Crocker recently joined its staff. Mr. Crocker, a graduate of M.I.T., served as a liaison officer between the research staff of the OSS and the British War Office during the late war and subsequently was on the chemical engineering staff of Arthur D. Little, Inc., and also has been associated as a chemical engineer with Overseas Consultants, Inc., who served as special consultants to the Secretary of the Army.

**Godfrey L. Cabot, Inc.,** 77 Franklin St., Boston 10, Mass., has appointed Frederick L. Graham the new representative in Paris for the sale of Cabot carbon black and pine distillates in France, to succeed the late V. Paschal. Mr. Graham who was graduated from Princeton University in 1937, has spent many years in France and French North Africa. During the war he served as liaison officer with the rank of lieutenant colonel in the French First Army and was awarded the French Croix de Guerre, with palm.

The appointment was made by Owen J. Brown, Jr., vice president and general sales manager of Godfrey L. Cabot, Inc., during a recent trip to Europe where he and Fred H. Amon, Cabot technical director, held conferences with principal sales representatives and consumers of Cabot raw materials.

**Donald F. Fraser** has resigned as manager of the rubber division, Monroe Auto Equipment Co., Hillsdale, Mich. On July 1 he joined the Queen City Tulatex Corp., Burlington, Vt., as general manager. This company produces rubberized curled fibre upholstery pads.

**A. C. Nispel, Inc.,** 131 Beverly St., Boston 14, Mass., New England sales agent for U. S. Industrial Chemicals, Inc., American Colloid Co., Kentucky Color & Chemical Co., and other manufacturers of raw materials for the rubber and the paint industries, has added to its staff, to expand Nispel interests in the rubber field, James H. Christopher, Jr. Mr. Christopher, a graduate of Brown University, had previously been connected with Bristol Mfg. Co. as chemist in charge of production, and with A. Schulman, Inc., and Titanium Pigment Corp. as sales representative.

# PACIFIC COAST

### Unusual Voit Campaigns

W. J. Voit Rubber Corp., 1600 E. 25th St., Los Angeles, Calif., has been waging an effective war against waste in its plants. The anti-waste campaign began in high gear last November with plantwide strategy meetings. All executives, managers, and department heads were called to assist in the drive, and planning committees were appointed. Publicity stunts were planned and executed, and the company's suggestion-plan system was stimulated by means of prizes. The first stunt consisted of spraying every nook and cranny of the main Voit plant with $300 worth of pennies during a fire drill. On the next day each employe received a bulletin pointing

E. Charlton Crocker

out that parts dropped and kicked around the floor, patches of fabric ruined by careless handling, tools damaged by improper use, rubber soiled or marred, and moments lost in loitering or chatting all represented thousands of dollars in lost pennies scattered wastefully through the plant each year. Anti-waste posters with cartoons and jingles were posted simultaneously throughout the plant.

During the first eight weeks following, material and time losses dropped 20%, production increased by 10%, and employe morale was substantially improved. To keep interest at a high level the campaign included daily and weekly meetings, contest awards totaling $2,500, suggestion-box awards on a profit percentage basis, distribution of booklets and leaflets, and publicity follow-up through the company house organ and bulletin boards. To date more than 100 new methods and techniques have been introduced, 10 new machines devised, and waste reduced by hundreds of dollars each day. These savings are being passed on to Voit dealers and distributers in the form of reduced costs. The company has added 10 new items to its line of athletic equipment; employe recreation has been expanded; and a healthy labor-management relation exists.

Voit began an unusual sales promotion campaign in May for its XB20 and CB2 basketballs. On the maiden voyage of the *S. S. President Wilson* from Los Angeles to the Orient, 25 Voit basketballs, one each noon, were cast overboard. Attached to each ball was a brass capsule containing the following message:

"This Voit basketball was thrown from the *S. S. President Wilson* during her maiden voyage from Los Angeles to the Orient in May, 1948. If you will return this ball and this message to us by June 15, 1950, we will send you postpaid one of our beautiful Voit Sports Chest complete with many items of Voit athletic equipment. Be sure to state your name and address, and the exact time and place of your finding this ball."

The company's name and address were given on the message. The first ball, cast overboard six miles outside Los Angeles harbor, was retrieved by a fisherman who subsequently received the Sports Chest. Oceanographers at Scripps Institute of Oceanography have requested data on the drift of the balls, and estimate that they may be retrieved from any of the four major oceans during the next few years. An extensive promotional campaign is planned to exploit all balls recovered from foreign waters and emphasize their waterproof and weatherproof qualities. In addition these balls will be promoted for use in official games and then exhibited throughout the country to demonstrate their proved endurance.

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**Gordon Hendry,** for many years associated with the United States Rubber Co., has been appointed principal adviser and assistant to Henry J. Kaiser, Jr. His work will be concerned with all activities of the Henry J. Kaiser Co. and its affiliates in Southern California.

**California Rubber Products, Inc.,** 130 N. Hawthorne Blvd., Hawthorne, Calif., has appointed Edward R. Evans technical sales and sales manager and Charles Arends factory manager.

# MIDWEST

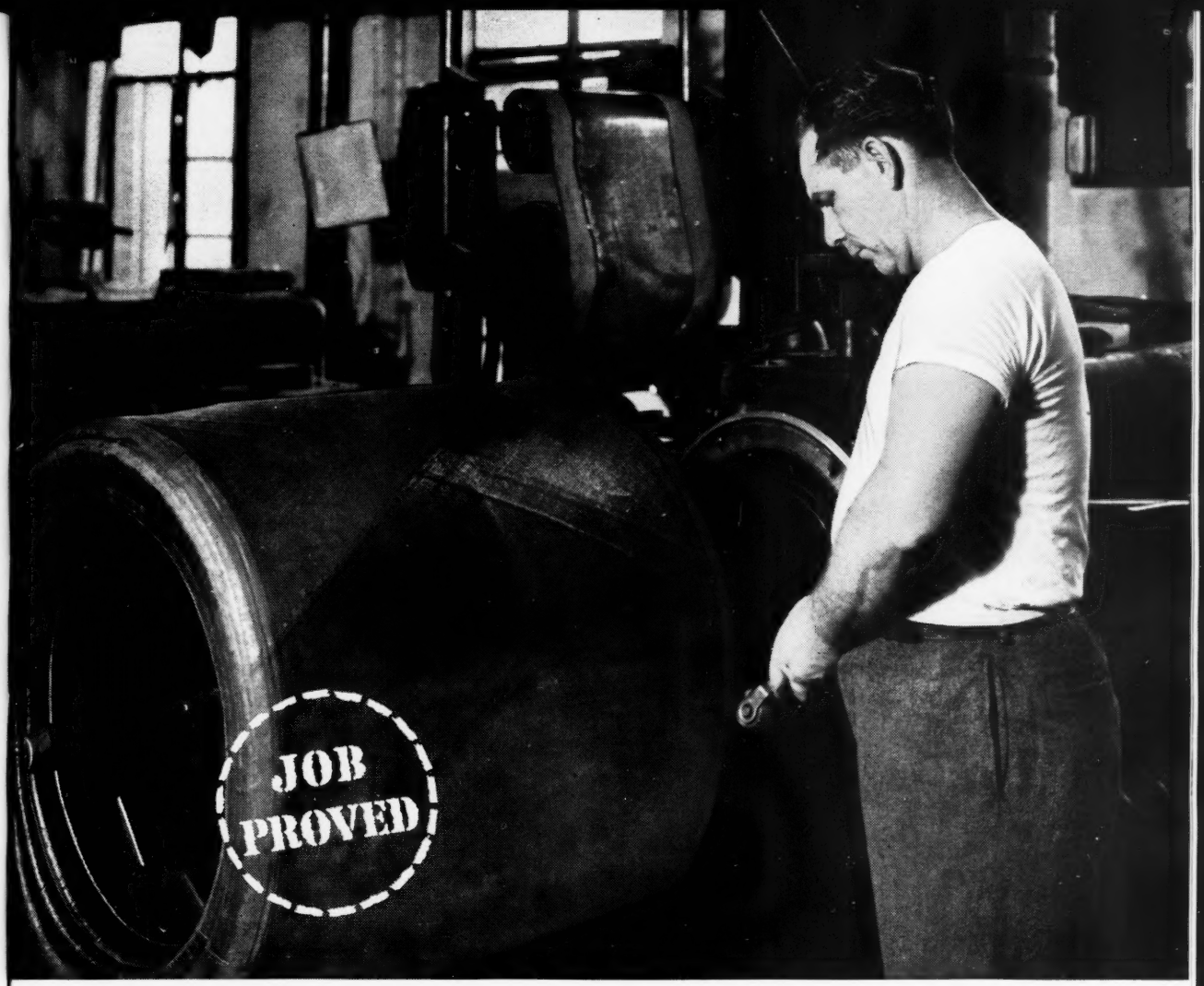
**Link-Belt Co.,** 307 N. Michigan Ave., Chicago 1, Ill., is erecting a new plant on a 10-acre plot on Wayside Dr., Houston, Tex. Included in the project will be a one-story, all-steel factory building with three bays, and a two-story office section of masonry construction in front. The plant proper will include a modern machine shop, structural steel shop, and large warehousing facilities. This new plant, comprising approximately 45,000 square feet of floor space, is being built to serve better the ever-expanding industries of the Southwest, either direct or through the company's factory branch stores and official distributers.

**Pittsburgh Plate Glass Co.,** Creighton, Pa., has awarded a research contract to the Bjorksten Research Laboratories, 185 N. Wabash Ave., Chicago 1, Ill. The research will embrace various problems in the field of development and improvement of a specialty product.

**Auburn Rubber Corp.,** Auburn, Ind., is greatly expanding its facilities and efforts in the manufacture of industrial rubber goods. As part of this expansion, William T. Exton has joined the company's staff and will be in direct charge of both production work and sales engineering of the mechanical rubber division. The decision to expand Auburn's activities in the industrial rubber goods field is said to stem from the ideal geographical location and available capacity of the company's plants at Auburn and at Connellsville, Pa.

**Monsanto Chemical Co.,** St. Louis, Mo., has named G. Theodore Barks, general superintendent of its new vinyl chloride production unit at Springfield, Mass. Mr. Barks had been division superintendent of United States Rubber Co.'s Fisk plant at Chicopee, Mass.

At the same time Carl T. King, production manager of Monsanto's plastics division at Springfield, said that Salvadore P. Lio, superintendent of the plant




# SAVING $4,800 A YEAR WITH CIRCOSOL-2XH

## Sun Rubber-Processing Aid Eliminates Extra Cementing Operation in Tire Plant

A manufacturer was using a mixture of 50 percent GR-S and 50 percent natural rubber for automobile, truck, and airplane tires. Pine oil and an ordinary type of processing oil were being added as plasticizers. This combination of oils affected the tack of the stock to such an extent that the various plies had to be cemented together in building up the carcass. Sheets often wrinkled in processing and had to be discarded.

A Sun Engineer was consulted. After studying the operation, he recommended Circosol-2XH—a rubber-processing aid developed by Sun for use with GR-S.

Following the introduction of Circosol-2XH the tack induced by processing was not destroyed, and the cementing operations were no longer necessary. Sheets no longer wrinkled. Waste was reduced. Savings in labor alone amounted to some $400 a month.

There's a "Job Proved" Sun product for every modern rubber-processing need. If you're having trouble with natural, reclaim, or synthetic rubbers, your Sun Engineer can help you. For complete information, just call your nearest Sun Office.

**SUN OIL COMPANY** · ***Philadelphia 3, Pa.***
*In Canada:* Sun Oil Company, Ltd.
Toronto and Montreal

**SUN PETROLEUM PRODUCTS**
**"JOB PROVED" IN EVERY INDUSTRY**

SUNOCO

technical group, would be transferred to operating superintendent of the new vinyl chloride plant, and Louis Schroeder of the research department would be area supervisor.

Monsanto announced in mid-1947 its plans for the production of the plastic vinyl chloride under the trade name Ultron. The production unit, a result of several years of research and extensive pilot-plant experimentation, will be finished this summer. Production of Ultron resin is expected in early fall.

### Donald F. Cranor

DONALD F. CRANOR, technical director of Binney & Smith Co., New York, N. Y., died of a heart attack in Paris, France, on July 3. Mr. Cranor had attended the Rubber Technology Conference in London, England, last month, where he read a paper, and had planned to spend some time on the Continent before returning home. Complete details are lacking at this time, but will be published next month.

# OBITUARY

### G. Ray Powell

AFTER a second heart attack suffered within one month G. Ray Powell, since February of this year western divisional manager for U. S. Tires division of United States Rubber Co., New York, N. Y., died June 15 in a Los Angeles, Calif., hospital.

Mr. Powell, 54, and a native of Crisfield, Md., had been with the rubber company since 1929, when he joined as a salesman in Baltimore, Md. Then in 1935 he was appointed assistant district manager at Philadelphia, Pa., and two years later district manager there. In 1942, Mr. Powell was made southern divisional sales manager with headquarters at Philadelphia, and a year later was transferred to Baltimore in a similar capacity. From 1945 until his last appointment he served the company at Atlanta, Ga.

He is survived by his wife and a daughter.

Burial was in Baltimore on June 19.

### Joseph Van Bemmel

JOSEPH VAN BEMMEL, veteran rubber broker, died on June 4 at his Teaneck, N. J., home. He was stricken with cerebral thrombosis.

In 1918 he began his long association with the rubber industry when he joined Littlejohn & Co. in its crude rubber department. He remained there until 1936 and in 1937 was employed by J. L. Handy & Co. From 1940 to 1942 he was manager of Little & Christman Rubber Co., Inc. Then in 1943 he became affiliated with Rubber Reserve Co. and remained there until his resignation in May of 1947. From 1946 until his resignation he was also special representative of the Reconstruction Finance Corp. in New York. He joined Farr & Co., 120 Wall St., New York 5, N. Y., in 1947 as an official in its crude rubber import department.

The deceased was for many years a member of the Panel of Quality Arbitrators of the Rubber Trade Association of New York, Inc. He was also a member of the Knights of Columbus.

Born August 27, 1893, at The Hague, Holland, Mr. Van Bemmel attended preparatory school in Tilburg, Holland.

Requiem Mass was said at the Holy Family Church, Union City, N. J., on June 8, followed by burial at Mount Carmel Cemetery, Tenafly, N. J.

Mr. Van Bemmel is survived by his wife, six sons, and a grandson.

# FINANCIAL

**Dayton Rubber Co.,** Dayton, O. Six months ended April 30: net profit, $249,798, equal to 45¢ each on 453,341 common shares, against $1,094,906, or $2.31 a share, a year earlier; net sales, $13,211,248, against $18,332,757.

**Jenkins Bros.,** Bridgeport, Conn. For 1947; net income, $836,027, or $6.39 each on 124,250 common shares, against $544,680, or $4.02 a share, in 1946; net sales, $10,247,037, against $9,055,704.

**Lee Rubber & Tire Corp.,** Conshohocken, Pa., and subsidiary. Six months ended April 30; net profit, 923,640, equal to $3.64 each on 253,584 capital shares, against 1,391,636, or $5.76 each on 241,509 shares, a year earlier; net sales, 16,665,913, against 19,278,294; reserve for income taxes, $652,000 against $990,000.

**Norwalk Tire & Rubber Co.,** Norwalk, Conn. Half-year to March 31: net loss, $29,730, contrasted with net profit of $186,519, equal to 92¢ a common share, in the 1947 period; sales, $3,402,194, against $5,622,667.

**Thermoid Co.,** Trenton, N. J., and subsidiaries. First quarter, 1948: net profit, $284,974, equal to 35¢ each on 716,588 common shares, against $261,464, or 36¢ each on 602,464 shares, in the first quarter last year; provision for income taxes, $184,057, against $192,844.

## Foreign Trade Opportunities

The firms and individuals listed below have recently expressed their interest in buying in the United States or in United States representations. Additional information concerning each import or export opportunity, including a World Trade Directory Report, is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, or through its field offices, for $1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangements.

#### Export Opportunities

Stylianos M. Mastorakis, representing George W. Mavridis & Co., 1 Rue Cherif Pasha, Alexandria, Egypt: tires.

Krishnagopal Malhotra, representing Empire Industrial Works and Lahore Chemical Works, both of Warden House, Sir Phirozshah Mehta Rd., Fort, Bombay, India: rubber compounding ingredients.

Oei Tjong Hauw, Asemka 18, Batavia, Java: machinery for rubber factories.

A. Lewin, representing Associated Agencies, Ltd., 33 Kingsway, Haifa, Palestine: plastics, rubber materials.

#### Import Opportunities

Etablissements Néo-Texarmé, 63 Blvd. de Ménilmontant, Paris, France: latex impregnated endless belting.

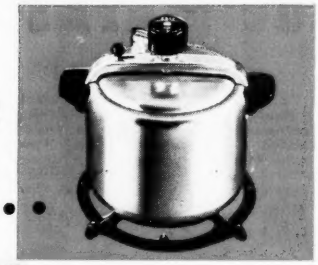
M. Wright & Sons, Ltd., Quorn Mills, Leics., England: narrow webbing, elastics.

AB Linde Kvarnmaskiner, Lindesberg, Sweden: ball-bearing wheels for rubber tires.

## Dividends Declared

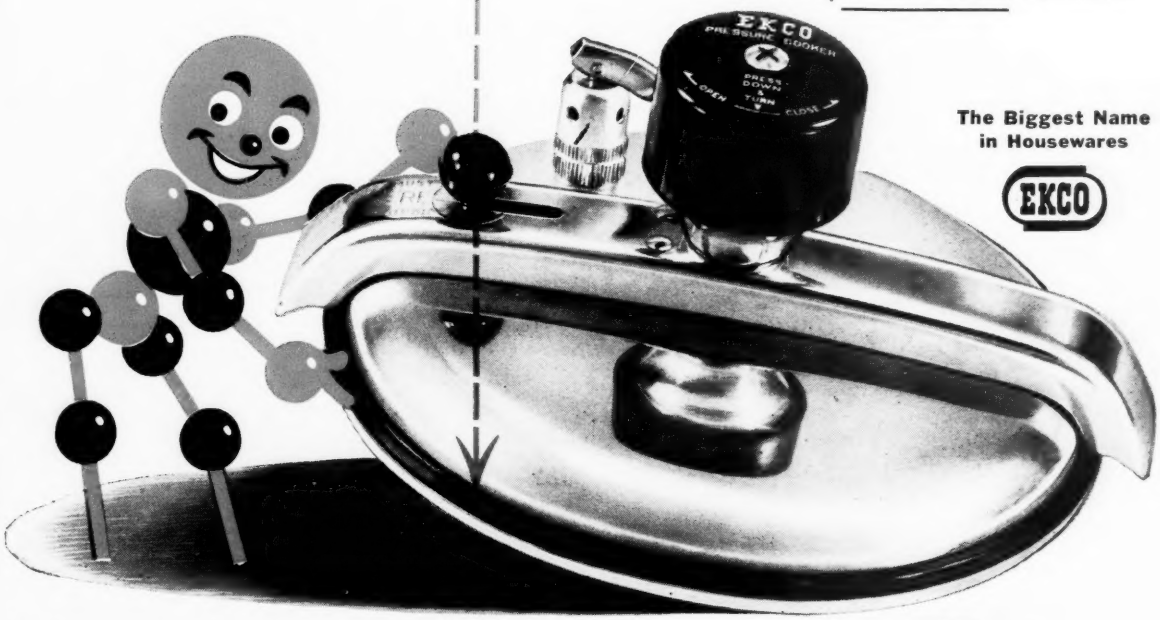
| Company | Stock | Rate | Payable | Stock of Record |
|---|---|---|---|---|
| American Hard Rubber Co. | Com. | $0.25 | June 30 | June 21 |
| American Hard Rubber Co. | Pfd. | 1.75 q. | June 30 | June 21 |
| Anaconda Wire & Cable Co. | Com. | 0.50 | July 20 | July 9 |
| Athol Mfg. Co. | Com. | 2.00 | July 1 | June 16 |
| Baldwin Rubber Co. | Com. | 0.15 | July 26 | July 15 |
| British Rubber Co. of Canada, Ltd. | Pfd. | 1.25 q. | July 31 | July 15 |
| Converse Rubber Corp. | 5% 1st Pfd. | 0.25 q. | July 8 | July 1 |
| Converse Rubber Corp. | 2nd Pfd. | 0.20 q. | July 8 | July 1 |
| Crown Cork & Seal, Ltd. | Com. | 0.50 q. | Aug. 16 | July 16 |
| Dayton Rubber Co. | Com. | 0.30 | July 26 | July 10 |
| Dayton Rubber Co. | "A" | 0.50 q. | July 26 | July 10 |
| Denman Tire & Rubber Co. | Com. | 0.10 q. | July 1 | June 26 |
| Denman Tire & Rubber Co. | Pfd. | 0.12½ q. | July 1 | June 26 |
| Detroit Gasket & Mfg. Co. | Com. | 0.12½ | July 26 | July 12 |
| Dunlop Rubber, Ltd. | ADR | 0.32⅛ | July 9 | May 28 |
| Endicott Johnson Corp. | Com. | 0.40 | July 1 | June 25 |
| Endicott Johnson Corp. | Pfd. | 1.00 q. | July 1 | June 24 |
| Firestone Tire & Rubber Co. | Com. | 1.00 | July 20 | July 6 |
| Garlock Packing Co. | Com. | 0.25 q. | June 30 | June 19 |
| General Cable Corp. | 1st Pfd | 1.00 q. | July 1 | June 25 |
| General Cable Corp. | 2nd Pfd. | 0.50 q. | July 1 | June 25 |
| General Cable Corp. | Com. | 0.25 | Aug. 2 | June 25 |
| General Tire & Rubber Co. | 4¼% Pfd. | 1.06¼ q. | June 30 | June 18 |
| General Tire & Rubber Co. | 3¾% Pfd. | 0.93¾ q. | June 30 | June 18 |
| General Tire & Rubber Co. | 3¼% Pfd. | 0.81¼ q. | June 30 | June 18 |
| Goodyear Tire & Rubber Co. of Canada, Ltd. | Pfd. | 0.50 | July 31 | July 10 |
| Jenkins Bros. | Com. | 0.50 | July 28 | June 18 |
| Jenkins Bros. | Com. | 0.37½ q. | July 2 | June 18 |
| Jenkins Bros. | Fdrs. | 1.50 q. | July 2 | June 18 |
| Jenkins Bros. | Pfd. | 1.75 q. | July 2 | June 18 |
| Johnson & Johnson | 1st Pfd. | 4.00 s. | July 31 | July 31 |
| Johnson & Johnson | 2nd Pfd. A | 1.00 q. | July 31 | July 14 |
| Johnson & Johnson | 2nd Pfd. B. | 0.87½ q. | July 31 | July 31 |
| Lee Rubber & Tire Corp. | Com. | 0.50 q. | Aug. 2 | July 15 |
| Mansfield Tire & Rubber Co. | Com. | 0.25 q. | June 21 | June 10 |
| Mansfield Tire & Rubber Co. | $1.20 Conv. Pfd. | 0.30 q. | July 1 | June 15 |
| Midwest Rubber Reclaiming Co. | Com. | 0.25 q. | Aug. 1 | July 12 |
| Okonite Co. | Com. | 1.00 q. | Aug. 2 | July 17 |
| O'Sullivan Rubber Corp. | Pfd. | 0.25 q. | July 1 | June 15 |
| Plymouth Rubber Co. | Com. | 0.12½ | July 15 | June 30 |
| Rome Cable Corp. | Com. | 0.15 q. | July 1 | June 11 |
| Rome Cable Corp. | Pfd. | 0.30 q. | July 1 | June 11 |
| Thermoid Co. | Pfd. | 0.62½ q. | Aug. 2 | July 21 |
| Union Asbestos & Rubber Co. | Com. | 0.25 incr. | Oct. 2 | Sept. 10 |

# When "the heat's on"... pressure, too, this PERBUNAN gasket can take it!



When deciding on a material for the gasket of their famous pressure cooker, the Ekco Products Company chose a *Perbunan* composition because it:

1. *Does not swell, soften or lose its shape under pressure at 250° F. even when exposed to most vegetable and animal fats and oils.*
2. *Does not harden or become brittle in use or when exposed to air.*
3. *Has no taste or odor, even when boiled in water for long periods of time; not harmed by washing in hot, soapy water.*
4. *Has good physical properties such as: (a) high tear resistance, (b) good tensile strength, (c) good elongation.*
5. *Materially reduced the manufacturing cost of the* EKCO *Pressure Cooker.*




The Biggest Name in Housewares

EKCO

Other manufacturers are finding new uses for versatile *Perbunan* every day. They like its toughness and the way it stands up under severe heat, cold and a wide variety of oils, acids, and greases . . . and they like its ready adaptability to the many complex molded shapes of resilient engineering materials.

NEW FEATURE: *Perbunan*'s new stabilizer permits the use of a wide variety of delicate shades that retain their original color.

Maybe there's a place in your business where the use of versatile *Perbunan* in a plastics or rubber part may save you plenty . . . both in initial cost and replacements. We will be glad to give you all the information you need.

**ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N.Y.**

PERBUNAN

REG. U. S. PAT. OFF.

THE RUBBER THAT RESISTS AIR, WATER, HEAT, COLD AND TIME

# Patents and Trade Marks

## APPLICATION

### United States

2,440,781. **Composition Including a Liquid Insecticide and, as Carrier therefor, Finely Divided Hard Rubber.** C. W. Murray, Glenside, Pa., assignor to the United States of America, as represented by the Secretary of Agriculture.

2,440,805. **Plastic Tire Cover.** G. A. Lyon, Allenhurst, N. J.

2,440,826. **Elastic Breast Supporting Sections in a Brassiere.** J. J. Lo Cascio, Bayonne, N. J., assignor to Even-Pul Foundations, Inc., New York, N. Y.

2,440,855. **In a Dust Eliminator Including a Cylinder and a Floating Piston Reciprocatively Movable within the Cylinder, Rubber Strands to Act as Noise Silencer for the Piston and for Cushioning thereof against the Heads of the Cylinder.** N. V. Goss, Weedsport, N. Y.

2,440,934. **Waterproof Shield for Toggle Switches.** R. R. and F. R. Gonsett, both of Los Angeles, Calif.

2,440,965. **Self-Sealing Fuel Tank Including a Supporting Layer, a Layer of Self-Sealing Gum, an Insulating Layer of Nylon, and a Layer of Partially Oil-Resistant Synthetic Rubber.** J. A. Merrill, Akron, and L. B. Sebrell, Cuyahoga Falls, assignors to Wingfoot Corp., Akron, both in O.

2,441,039. **Spring Heel for Footwear.** H. H. Smith and W. Milk, Bay Shore, N. Y.

2,441,062. **In a Wind Whip Drier Including Upper and Lower Hollow Casings, a Rubber Band on the Upper Edge of the Lower Casing and Clamping Devices Including Rubber Pads on the Outside of the Lower Casing.** O. Elsebusch, Los Angeles, Calif.

2,441,206. **Fluid-Tight Seal.** P. Pevney, Massapequa, N. Y., assignor to Republic Aviation Corp., a corporation of Del.

2,441,236. **Extensible Electric Conductor.** P. J. M. Dansard, St.-Chamond, France.

2,441,304. **Combination Cable Clamp and Insulating Device for Guylines, Largely Made of High Dielectric Plastic.** M. A. West, Portland, Oreg.

2,441,443. **Elastic Garment.** N. B. Reed, assignor to Surgical Products, Inc., both of Lowell, Mass.

2,441,508. **Colostomy Drain Bag.** V. J. Porcelli, Jackson Heights, L. I., N. Y.

2,441,510. **Vibration Absorbing Mounting.** C. S. Robinson, assignor of one-half to D. H. Robinson, both of New York, N. Y.

2,441,514. **Plug Seal for Containers.** J. M. Schorr, New Orleans, La.

2,441,545. **Garter.** G. C. Mason, assignor to Gem-Dandy Inc., both of Madison, N. C.

2,441,682. **Rubber Element in a Massage Head.** W. M. Wybrants, New York, N. Y.

2,441,699. **In Apparatus for Molding Wood Veneer, a Flexible, Expansible Membrane.** C. U. Gramelspacher, Jasper, Ind.

2,441,788. **Lady's Plastic Hat.** S. Behr, Flushing, N. Y.

2,441,866. **Eardrum Protector.** J. J. Cantor, Los Angeles, Calif.

2,441,868. **Apparatus for Massaging Parts of the Body, Including a Cup-Like Member Having a Hollow Stem for Air Evacuation, a Rubber Tube Connected with This Stem, and a Rubber Bulb Connected with the Tube.** L. A. Casnati, New York, N. Y.

2,441,879. **Ventilating Means for a Shoe.** R. R. Gantt, San Antonio, Tex.

2,442,037. **Wedge-Type Driving Belt.** R. S. Carter, Cuyahoga Falls, and M. L. Dorf, assignors to Wingfoot Corp., both of Akron, both in O.

2,442,044. **Laundry Bag Including a Bag of Soft, Oilproof Rubber Composition and a Sealing Strip of Oilproof Rubber between Fastener Elements.** F. A. Howard, Elizabeth, N. J., assignor to Standard Oil Development Co., a corporation of Del.

2,442,091. **Pouch of Pliable Plastic Material.** A. Mann, Valley Stream, N. Y., and M. Bass, Perth Amboy, N. J., assignors to Breslee Mfg. Co., New York, N. Y.

2,442,111. **Read-to-Use Finger Bandage.** C. S. Beardsley, Elkhart, Ind.

2,442,151. **Pneumatic Artificial Foot.** E. L. Strickland, Richmond, Calif.

2,442,278. **A Sheet of Resilient Packing Material in Apparatus for Irrigating Cavities and Passages of the Body.** R. A. Van Hasbroeck, London, England.

2,442,279. **Laminated Thread, Including a Flat Ribbon of Polyvinyl Alcohol to the Surface of Which Adheres a Film of Rubber.** S. W. Alderfer, Akron, O.

2,442,311. **Composite Compressible Gasket for Sealing Pipe Flanges, Including a Spirally Wound Continuous Metal Strip and a Layer of Non-Metallic Compressible Packing Material Spirally Wound between the Convolutions of the Metal Strip.** W. R. Price, Rosemont, Pa., assignor to Flexitallic Gasket Co., Camden, N. J.

### Dominion of Canada

448,070. **Closure Means, Including an Inflatable Gasket.** M. F. Kemper, Los Angeles, Calif., U.S.A.

448,071. **In a Propeller Mounting, a Drive Shaft, a Propeller Having a Hub, and a Resilient Rubber Insert between Hub and Shaft to Transmit Driving Forces therebetween.** E. C. Kiekhaefer, Cedarburg, Wis., U.S.A.

448,080. **Packing Formed of Sheets of Plastic Material.** C. Nicolle, Gentilly, Seine, France.

448,140. **In a Contact Printer, a Platen Formed as an Endless Belt of Resilient Material.** C. H. Jacobson, Binghamton, assignor to General Aniline & Film Corp., New York, both in N. Y., U.S.A.

448,145. **Seamless Dipped Latex Girdle.** A. N. Spanel, Princeton, N. J., assignor to International Latex Corp., Dover, Del.

448,158. **Felt, Especially for Paper Making or Similar Machines, Characterized by a Wool Fiber Base Impregnated with a Cured Urea-Formaldehyde Resin.** N. T. Beynon, Dayton, assignor to Orr Felt & Blanket Co., Piqua, both in O., U.S.A.

448,159. **Felt, Especially for Paper Making and Like Machines, Having a Wool Fiber Base Impregnated with a Cured Mixture of Rubber Latex and Urea-Formaldehyde Resin.** N. T. Beynon, Dayton, assignor to Orr Felt & Blanket Co., Piqua, both in O., U.S.A.

448,160. **Felt, Especially for Paper Making or the Like, Having a Base Impregnated with a Mixture of Polyvinyl Alcohol and an Aqueous Emulsion or Solution of Synthetic Rubber of Synthetic Resin.** O. W. Berglund, Dayton, assignor to Orr Felt & Blanket Co., Piqua, both in O., U.S.A.

448,213. **Lightweight, Gastight Lamination, Including a Sheet of a Copolymer of Vinylidene and a Vinyl Ester, Cemented to a Woven Fabric of Linear Polyamide Resin Fibers by an Adhesive, a Polymer of Vinyl Chloride.** O. W. Loudenslager and J. E. Wilson, assignors to Wingfoot Corp., all of Akron, O., U.S.A.

448,214. **Belt-Type Vehicle Track.** M. Lammertse, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O., U.S.A.

448,280. **Fuel Tank Fitting, Including a Disk of Layers of Rubberized Textile Fabric to Form a Vulcanized Connection with the Tank Wall.** M. M. Cunningham, South Bend, Ind., U.S.A., assignor to Dominion Rubber Co., Ltd., Montreal, P.Q.

448,341. **In an Endless Track of the Locked Girder Type Having Links of Separately Made Ground Plates, Blocks of Resilient Material between Portions of Adjacent Links.** P. H. Johnson, assignor to Roadless Traction, Ltd., both of Hounslow, Middlesex, England.

448,357. **In a Shaft Seal Having a Seal Ring Slidably Mounted on the Shaft, the Improvement of a Rubber Sleeve with a Reduced Diameter Collar Portion Seated on the Shaft, an Enlarged Collar Portion Surrounding the Sea Ring, and a Flexible Diaphragm Portion Connecting the Collar Portions.** R. R. Curtis, Dayton, assignor to Thompson Products, Inc., Cleveland, both in O., U.S.A.

448,358. **Pump Seal.** R. R. Curtis and R. L. Gates, Dayton, assignors to Thompson Products, Inc., Cleveland, both in O., U.S.A.

448,359. **Pump Seal Construction.** R. R. Curtis, Dayton, assignor to Thompson Products Inc., Cleveland, both in U.S.A.

448,420. **Pressed Ligno-Cellulosic Products.** H. K. Linzell, Long Lake, assignor to United States Gypsum Co., Chicago, both in Ill., U.S.A., assignor to Canadian Gypsum Co., Ltd., Windsor, N. S.

448,430. **In a Fluid Seal, a Central Ring Member of Rubber-Like Material.** A. J. Matter, Park Ridge, assignor to Crane Packing Co., Chicago, both in Ill., U.S.A.

448,444. **Refrigerant Breaker Strip Construction, Including a Rubber Strip.** B. C. Johnson, Mundelein, Ill., assignor to Houdaille-Hershey Corp., Detroit, Mich., both in the U.S.A.

448,446. **Milk Filter Formed from Cellulose Fibers and Thermoplastic Waterproof Binder Fibers Bonded by the Latter.** J. F. Ryan, assignor to Kendall Co., both of Walpole, Mass., U.S.A.

448,453. **Laminated Container Having Wall Portions of a Heat-Sealable Sheet, and an Intercalated Film of Flexible, Thermoplastic Film.** R. A. Farrell and C. L. Wagner, both of Nenasha, assignors to Marathon Corp., Rothschild, both in Wis., U.S.A.

448,501. **String of Resin-Impregnated Paper.** J. H. Watson and H. E. Anderson, both of Linwood, Renfrewshire, Scotland, and E. R. Angel, Beaconfield, Buckinghamshire, England.

448,512. **Windshield Wiper.** J. Dimoff, Hurkett, Ont.

448,578. **Fluid Seal.** H. M. Dodge, Wabash, Ind., assignor to General Tire & Rubber Co., Akron, O., both in the U.S.A.

448,582. **Resin-Impregnated Woven Textile Fabric.** R. C. Whitman, Walpole, assignor to Kendall Co., Boston, both in Mass., U.S.A.

448,621. **Belt for Personal Wear, Including a Folded Fabric Bonded together by an Intermediate Fabric Containing Thermoplastic Material.** D. C. Lippmann, assignor to C. Dreyfus, both of New York, N. Y., U.S.A.

### United Kingdom

598,711. **Balls for Tennis and Other Games.** Henley's Tire & Rubber Co., Ltd., and W. S. Penn.

598,736. **Flexible Bearings or Mountings.** Silentbloc, Ltd., and P. C. Hutton.

598,765. **Rubber Mats, Floor Coverings, or Road Coverings.** A. R. V. Kearsley.

600,304. **Protective Clothing and Flotation Suits.** B. F. Goodrich Co.

600,489. **Inflatable Articles of Clothing.** P. Frankenstein & Sons (Manchester), Ltd., E. A. Pask and J. Silverstone.

600,697. **Laminated Power Transmission Belts.** R. W. Duncan.

601,259. **Sealing Ends for Electric Cables.** Callender's Cable & Construction Co., Ltd., L. G. Brazier and D. T. Hollingsworth.

601,296. **Sealing Devices between Relatively Rotating Members.** Crane Packing, Ltd., and F. C. W. Wilkinson.

601,301. **Composite Rubber Article.** Dunlop Rubber Co., Ltd., M. Langstreth, and L. F. Pickup.

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## PROCESS

### United States

2,440,725. **Composite Plastic-Lined Metal Pipe.** C. G. Munger, San Gabriel, Calif., assignor to American Pipe & Construction Co., a corporation of Del.

2,440,789. **Molding Resin-Bearing Vegetable Shell Material.** E. Van de Pyl, Holden, Mass., assignor to Agicide Laboratories, Inc., Racine, Wis.

2,440,802. **Plastic Insulated Electrical Conductors.** C. J. Krogel, Cranford, N. J., assignor to Western Electric Co., Inc., New York, N. Y.

2,441,071. **Forming Tire Plies.** C. J. Jahant, assignor to General Tire & Rubber Co., both of Akron, O.

2,441,227. **Applying a Temporary Protective Coating to an Article with an Opening in a Wall thereof.** B. M. Pineles, Hamilton, Mass., assignor to United Shoe Machinery Corp., Flemington, N. J.

2,441,492. **Preparing Moldable Plastics Compositions of Dry Thermo-Responsive Resinous Plastics and Filler Material in the Form of a Web of Loosely Compacted Filler Elements.** A. W. Koon and J. P. Thatcher, assignors to Columbian Rope Co., all of Auburn, N. Y.

2,441,905. **Seamless Hollow Articles from Natural or Synthetic Rubber.** C. Saint-Mieux, assignor to Societe Meridionale du Caoutchouc S. O. M. E. C. A., both of Carcassonne, France.

2,442,161. **Gas-Filled Flexible Containers.** S. Bergstein, Cincinnati, O.

### Dominion of Canada

448,137. **Self-Sealing Fuel Cell.** E. E. Hanson, assignor to Firestone Tire & Rubber Co., both of Akron, O., U.S.A.

448,217. **Compact Bonded Yarn.** W. Whitehead, assignor to C. Dreyfus, both of New York, N. Y., U.S.A.

448,384. **Reinforced Plastic Material.** H. Kremer, London, England.

448,435. **Forming a Package of Resinous Thermoplastic Material.** C. E. Slaughter, New Canaan, assignor to Extruded Plastics, Inc., Norwalk, both in Conn., U.S.A.

448,488. **Insulated Conductor.** G. R. Brown, Newark, N. J., assignor to Western Electric Co., Inc., New York, N. Y. both in the U.S.A.

448,573. **Embossed Microporous Rubber**

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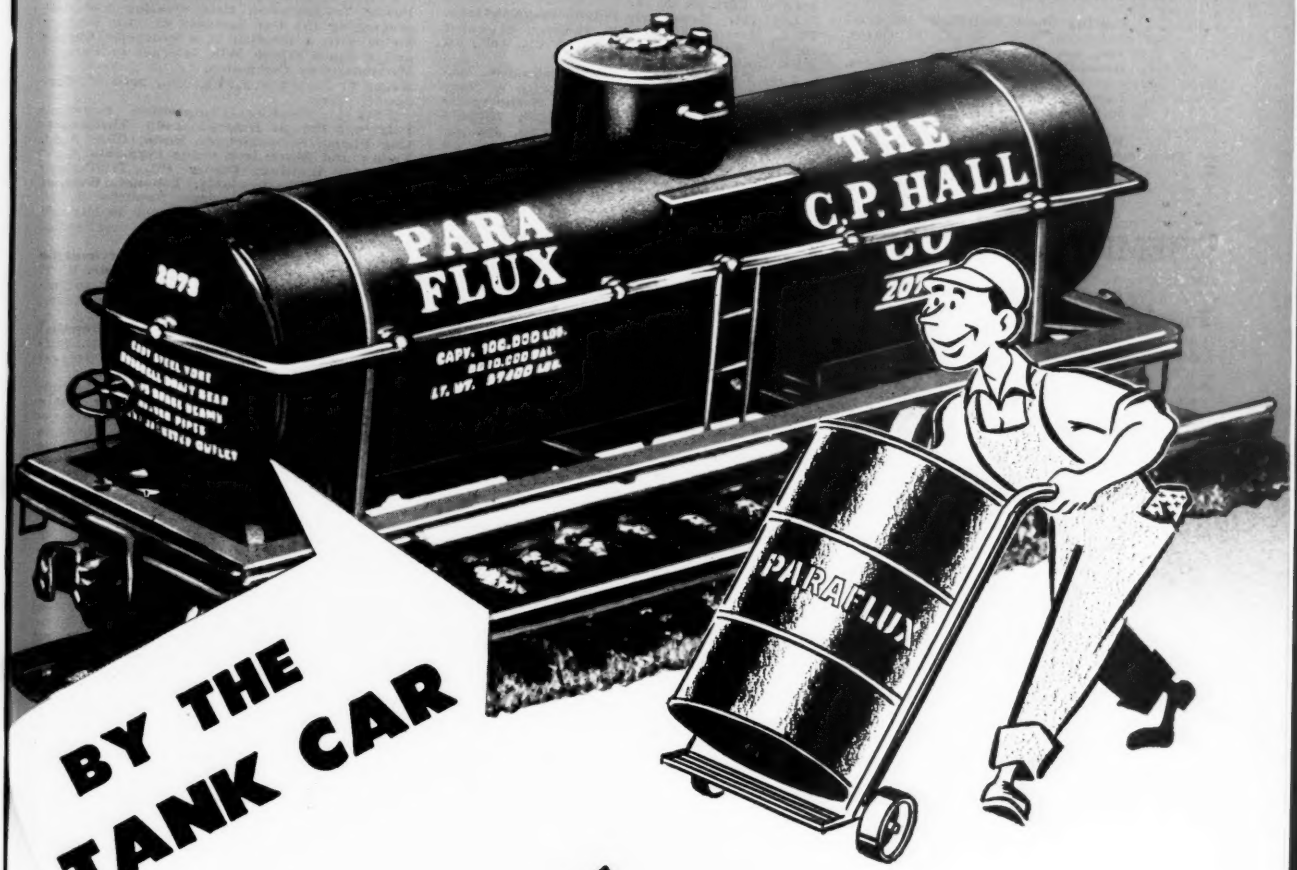


**BY THE TANK CAR**

**OR BY THE DRUM**

For 26 years PARA FLUX has been the Standard of the Rubber Industry, its quality is always the same whether you are a drum or tank car user.

*The* **C.P. Hall Co.**
CHEMICAL MANUFACTURERS

AKRON, OHIO • LOS ANGELES, CALIF. • CHICAGO, ILL. • SAN FRANCISCO, CALIF.

**Battery Separator.** E. C. Uhlig, Greenwood, R. I., U.S.A., assignor to Dominion Rubber Co., Ltd., Montreal, P.Q.

### United Kingdom

598,785. **Molded Articles from Vegetable Material.** A. S. P. Chemical Co., Ltd., C. L. Walsh, B. A. Adams, and R. C. Barker.

598,872. **Creaming Synthetic Rubber Latices.** T. A. Clayton (United States Rubber Co.).

600,575. **Preparing and Treating Plastic Fabrications.** R. Anderson.

600,602. **Resin-Containing Fibrous Sheet or Board.** E. H. G. Sargent.

600,669. **Heating Molding Materials by High-Frequency Electric Fields.** General Electric Co., Ltd., E. M. Leyton, and H. M. Nelson.

600,687. **Coating Sheet Material.** Imperial Chemical Industries, Ltd., W. E. F. Gates, J. W. Davison, and G. W. Worrall.

600,948. **Resin-Bonded or Shaped Articles.** Shell Development Co.

601,050. **Lamination of Sheet Material.** E. I. du Pont de Nemours & Co., Inc., and E. A. Bingen.

601,256. **Welding Together Films or Sheets of Thermoplastic Materials.** G. Haim and H. P. Zade.

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# CHEMICAL

### United States

2,440,671. **Hydrogenation of Butdadiene-Sulfones to Thiophenes.** J. H. Boyd, Jr., Hudson Township, O., assignor to Phillips Petroleum Co., a corporation of Del.

2,440,713. **Solid Methyl Methacrylate Polymer Coated with a Solution of Hydrolyzed Ethyl Silicate and a Polyvinyl Butyral Resin, and a Second Coating Solution of Hydrolyzed Ethyl Silicate and a Vinyl Acetate Polymer.** M. F. Bechtold, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,440,724. **N-Substituted. 2-Butene-1,4 Diamines.** G. H. Morey, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

2,440,750. **Polymerization Catalysts Consisting Essentially of Aluminum Alcoholate and Aluminum Chloride.** C. A. Kraus, Providence, R. I., and J. D. Calfee, Manhasset, N. Y., assignors to Standard Oil Development Co., a corporation of Del.

2,440,801. **Preparing Liquid to Solid Compounds from Olefinic Compounds Reacted with Hydrogen Chloride.** W. E. Hanford and J. Harmon, assignors to E. I du Pont de Nemours & Co., Inc., all of Wilmington, Del.

2,440,808. **Polymerization of an Ethenoid Material Dispersed in Water in Which Is Incorporated, as Dispersing Agent, a Complex, Hydrous Magnesium Silicate Which Swells in Water, forming Gels therewith.** H. T. Neher, Bristol, and F. J. Glavis, Elkins Park, assignors to Rohm & Haas Co., Philadelphia, all in Pa.

2,440,893. **Preparing Sponge Rubber with Use of a Lower Substituted Nitro Alkanol to Inhibit Premature Vulcanization of the Rubber.** A. W. Campbell, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

2,440,899. **Insulation Compound for an Airplane Motor Ignition Conductor Including a Leathery Mass Prepared from a Mixture of Benzyl Cellulose Ether or Alkyl Ethers of Cellulose, and a Solid Vinyl Formal, Vinyl Butyral, or Vinyl Acetal Polymer, and a Plasticizer.** M. T. Harvey, South Orange, N. J., assignor to Harvel Corp., a corporation of N. J.

2,440,909. **Polymeric Condensation Products Prepared from a Phenol and 2,6-Dimethyl-ol-4-*n*-octylphenol.** J. B. Niederl, Brooklyn, N. Y.

2,440,985. **Vinyl Resins Containing Alkenyl Succinic Esters.** L. T. Sutherland, Yonkers, assignor to Allied Chemical & Dye Corp., New York, both in N. Y.

2,441,032. **Acyl Thiocarbamo Sulfenamides.** P. T. Paul, Naugatuck, Conn., assignor to United States Rubber Co., New York, N. Y.

2,441,066. **Polymeric Silicon Compounds Obtained by Reacting a Substance Containing Alcoholic Hydroxyl Groups Attached to a Hydrocarbon Residue with a Hydrocarbon Silicanohalide.** W. E. Hanford, Easton, Pa., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,441,068. **Polymeric Substances Containing a Drying Oil Fatty Acid Radical and Capable of Drying by Oxidation under Atmospheric Conditions, Obtained by Heating Polymethyl Methacrylate with a Drying Oil Diglyceride in the Presence of an Alcoholysis Catalyst.** D. H. Hewitt and F. Armitage, both of Homerton, London, England.

2,441,082. **Thermosetting Formaldehyde-Treated Monoolefin Carbon Monoxide Polymers.** P. S. Pinkney, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,441,085. **Nylon Fabrics Made Elastic by Treatment with a Solution Including Formaldehyde, an Aliphatic Alcohol, and an Oxygen Containing Acid Catalyst.** A. K. Schneider, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,441,090. **Dispersing Carbon Black in a Synthetic Rubber Elastomer.** T. A. Te Grotenhuis, Olmsted Falls, and C. B. Frost, assignors to General Tire & Rubber Co., both of Akron, both in O.

2,441,098. **Methyl Siloxane Polymers.** J. F. Hyde, assignor to Corning Glass Works, both of Corning, N. Y.

2,441,128. **Monomeric Polyfluorocyclobutane.** P. L. Barrick and R. D. Cramer, assignors to E. I. du Pont de Nemours & Co., Inc., all of Wilmington, Del.

2,441,172. **For Closures of Cellulosic Material, a Cushion Liner Coated with a Thermoplastic Film of N-Butyl Methacrylate Resin, Amorphoid Wax, and Finely Divided Clay.** A. H. Warth and P. Grabus, Jr., assignors to Crown Cork & Seal Co., Inc., all of Baltimore, Md.

2,441,223. **As Accelerator of Vulcanization, a Condensation Product of a 2-Mercaptothiozole, Formaldehyde, and Ammonia.** M. W. Harman, Nitro, W. Va., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,441,241. **Plastic Composition, Including a Vinyl Resin and, as Plasticizer, a Hexitan Tetra-Ester.** R. M. Goepp, Jr., New Castle, assignor to Atlas Powder Co., Wilmington, both in Del.

2,441,320. **Organo-Siloxanes.** J. F. Hyde, assignor to Corning Glass Works, both of Corning, N. Y.

2,441,328. **In the Cyclic Process for Producing Rubber Hydrochloride Film, Distillation of the Recovered Solvent before Reuse.** H. J. Osterhof, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O.

2,441,360. **Treating Vinyl Chloride-Containing Polymers Subject to Thermal Decomposition under Heat Processing with an N-Chloro-Hydantoin to Remove Discoloration and Stabilize the Polymer against Thermal Decomposition.** C. G. Kamin, Great Lakes, Ill., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,441,422-423. **Organosilicon-Silica Sols, Gels and Aerogels.** R. H. Krieble and J. R. Elliott, both of Schenectady, N. Y., assignors to General Electric Co., a corporation of N. Y.

2,441,462. **Distilling Alpha-Methacrylonitrile from Acetone Cyanohydrin and Phosphorus Pentoxide Brought together in the Presence of Liquid Sulfur Dioxide.** W. M. Zeischke, St. Louis, Mo., assignor to American Cyanamid Co., New York, N. Y.

2,441,470. **Insolubilizing Hydrolyzed Polyvinyl Acetate.** T. S. Carswell, Longmeadow, Mass., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,441,515. **Interpolymers of Styrene, an Allylic Acrylate, and an Allylic Alcohol.** R. H. Snyder, Newark, N. J., assignor to United States Rubber Co., New York, N. Y.

2,441,516. **Interpolymers of Allylic Alcohol and Allylic Acrylates.** R. H. Snyder, Newark, N. J., assignor to United States Rubber Co., New York, N. Y.

2,441,542. **Fabric Coating, Including a Polyvinyl Butyraldehyde Acetal Resin and a Phenol-Aniline Resin.** R. R. Lawrence, Ludlow, Mass., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,441,555. **Mixed Ester of a Polyhydric Alcohol from the Group of Pentaerythritol and Polypentaerythritols.** R. H. Barth, Ridgewood, and H. Burrell, Paramus, both in N. J., assignors to Heyden Chemical Corp., New York, N. Y.

2,441,597. **Polypentaerythritols.** J. P. Remensnyder, Metuchen, N. J., P. I. Bowman, Syracuse, N. Y., and R. H. Barth, Ridgewood, N. J., assignors to Heyden Chemical Corp., New York, N. Y.

2,441,799. **Resinous Composition, the Polymerization Product of a Mixture Including Diallyl Fumarate and Modified Unsaturated Alkyd Resin.** G. F. D'Alelio, Shaker Heights, O., assignor to General Electric Co., a corporation of N. Y.

2,441,826. **For Curing Freshly Placed Concrete, a Liquid Composition Including Coumarone-Indene Resin, Terpene Resin, or a Methylated Indene-Methylated Styrene Resin, a Rosin Material and a Volatile Hydrocarbon Solvent.** R. E. Madison, assignor to Truscon Laboratories, Inc., both of Detroit, Mich.

2,441,860. **Accelerated Curing of Phenol-Formaldehyde Resins to the Infusible State with 3,5-Xylenol.** R. R. Whestone, Berkeley, assignor to Shell Development Co., San Francisco, both in Calif.

2,441,944. **Polypentaerythritols.** J. P. Remensnyder, Metuchen, N. J., P. Bowman, Syracuse, N. Y., and R. H. Barth, Ridgewood, N. J., assignors to Heyden Chemical Corp., New York, N. Y.

2,441,945. **For Manufacturing Automobile Tires, a Composition Including a Copolymer of a Major Proportion of Isobutylene with a Minor Proportion of a Diolefin Having 4 to 6 Carbon Atoms, and Pulverized Copper.** P. K. Frolich, Westfield, and I. E. Lightbown, Roselle, both in N. J., assignors, by mesne assignments, to Jasco, Inc., a corporation of La.

2,441,946. **Soybean Protein-Phenolic Resin Adhesive.** R. H. Hieronymus, assignor to Drackett Co., both of Cincinnati, O.

2,441,953. **Finishing Wood Surfaces with Synthetic Resin Coatings.** W. E. Berry and M. M. Wilson, both of Cincinnati, O., assignors to Interchemical Corp., New York, N. Y.

2,441,970. **In a Method of Making a Leather Power Transmission Belt, Coating and Impregnating the Cut Surfaces of Two Leather Strips with a Solution of a Synthetic Rubber and a Resin Which Will Interact to Form a Thermosetting Compound.** S. D. Leseine, assignor to Graton & Knight Co., both of Worcester, Mass.

2,442,018. **Coating Composition Including Polyvinyl Partial Butyral Resin, Thermosetting Phenol-Formaldehyde Resin, Oleic Acid, Yellow and Black Iron Oxide Pigments, Lead Titanate, Whiting, Castor Oil, Triethylene Glycol di(2-Ethylhexoate), Ethanol, Butanol and Hydrogenated Petroleum Naphtha.** R. W. Quarles, Pittsburgh, Pa., assignor to Carbide & Carbon Chemicals Corp., a corporation of N. Y.

2,442,040. **Manufacture of Acrylonitrile from Acetylene and Hydrocyanic Acide.** R. T. Foster, Birkenhead, England, assignor to Imperial Chemical Industries, Ltd., a corporation of Great Britain.

2,442,059. **Rubbery Butyl Gum-Dimethyl Polysiloxane Gum Composition.** M. M. Safford, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,442,068. **In a Flexible Structure Including a Body of Cured Natural Rubber and a Body of Cured Interpolymer of Isobutylene and a Polyolefin, and Interposed Tie-Gum Layer Including a Polymer of Isobutylene and a Polyolefin Treated with Sulfur and Sulfur-Chloride.** R. F. Wolf, Westfield, and W. J. Sparks, Elizabeth, both in N. J., assignors to Standard Oil Development Co., a corporation of Del.

2,442,083. **Adhesive Composition, Including in an Organic Solvent a Copolymer of Isobutylene and a Diolefin, a Quinone-Oximino Compound, and N-Chlorobenzamide.** F. M. Hall and R. W. Griffith, Naugatuck, Conn., assignors to United States Rubber Co., New York, N. Y.

2,442,085. **Thermal Copolymer of a Drying Oil and Polychloroprene.** C. E. Huff and J. H. Clynch, both of Mishawaka, Ind., assignors to United States Rubber Co., New York, N. Y.

2,442,086. **Thermal Copolymer of a Vegetable Drying Oil with Butadiene-1,3-Styrene Copolymer Rubber.** C. E. Huff and J. H. Clynch, both of Mishawaka, Ind., assignors to United States Rubber Co., New York, N. Y.

2,442,089. **Plasticizers Obtained from Chlorinated Kerosene Refluxed with Phenol in the Presence of a Condensation Catalyst.** E. Lieber, New York, N. Y., assignor to Standard Oil Development Co., a corporation of Del.

2,442,196. **Modified Methyl Polysiloxane Compositions.** A. D. Coggeshall, Schenectady, N. Y., assignor to General Electrical Co., a corporation of N. Y.

2,442,200. **Rubber Composition Containing Copper, Cobalt, Iron, or Their Compounds, Normally Effective to Catalyze Oxidation of the Rubber, and to Deactivate the Catalyst a Metal Deactivator Having the Formula HO-R-(CH=N-R')—OH Wherein Each of R and R' Represents an Ortho Arylene Radical.** F. B. Downing and C. J. Pedersen, both of Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,442,212. **Organo-Silicon Resin.** E. G. Rochow, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,442,218. **Processing a Low-Temperature Interpolymer of Isobutylene with a Conjugated Diolefin, by Treating the Polymer with a Sulfur Chloride, Withdrawing Hydrogen Chloride from the Treated Polymer, and Then Milling to Incorporate Compounding Ingredients.** W. J. Sparks, Elizabeth, and R. M. Thomas, Union, both in N. J., assignors to Jasco, Inc., a corporation of La.

2,442,229-230. **Azeotropic Distillation of Chloroethyl Benzene from Chlorostyrene.** L. Berg, O'Hara Township, and J. M. Harrison, Oakmont, assignors to Gulf Research & Development Co., Pittsburgh, all in Pa.

2,442,283. **Emulsion Copolymerization of Vinylfurane and Styrene.** W. Bock, Cologne, Germany, assignor, by mesne assignments, to General Aniline & Film Corp., New York, Syracuse, N. Y., and R. H. Barth, Ridgewood, N. J., assignors to Heyden Chemical Corp., New York, N. Y.

# TALES WORTH RETELLING

(No. 6 of a series)

## THE TWO FROGS

TWO FROGS dwelled in the same pool. The hot summer came and dried it up, so that they were forced to sally forth to look for other water.

After a hot and dusty search, the Frogs, parched and weary, chanced to find a deep well full of cool water.

"Let us jump in here!" cried one.

"Wait a bit," counselled the other: "if this were to dry up, how could we ever get out again?"

★ ★ ★

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**CRUDE RUBBER · SYNTHETIC RUBBER · SCRAP RUBBER · HARD RUBBER DUST · PLASTIC SCRAP**

2,442,220. **Dehydrogenation of Monoolefins to Diolefins Catalyzed by Calcium Nickel Phosphate-Chromium Oxide Composite.** E. C. Britton and A. J. Dietzler, assignors to Dow Chemical Co., all of Midland, Mich.

## Dominion of Canada

448,130. **Preparation of Chloranil by Chlorinating Pentachlorophenol Suspended in Sulfuric Acid and Hydrolyzing the Resulting Reaction Product.** W. P. ter Horst, Pompton Plains, N. J., C. H. Stiteler, Naugatuck, and G. F. Smith, Middlebury, both in Conn., both in the U.S.A., assignors to Dominion Rubber Co., Ltd., Montreal, P.Q.

448,156. **Aniline Formaldehyde Resin.** L. Goes, Jr., Brookfield, assignor to Norton Co., Worcester, both in Mass., U.S.A.

448,157. **Resinous Product, the Water-Free and Insoluble Reaction Product of an Aminated Phenol Aldehyde Resin and a Cross-Linking Resin Solvent Hardening Agent, Which Is an Alkylating Polyhalide in Which the Halogen Is Chlorine, Bromine or Iodine.** L. Coes, Jr., Brookfield, assignor to Norton Co., Worcester, both in Mass., U.S.A.

448,194. **Bonding Vulcanizable Surfaces Containing Polymerized Chloroprene by Applying a Film Containing, as Sole Active Ingredient, a Compound of the Group of Dibutyl Phthalate, Tricresyl Phosphate, Ethyl Acetate, Butyl Acetate, Ethyl Acetoacetate, Methyl Salicylate, Methyl Benzoate, Triethylene-Glycol-Di-2-Ethyl Butyrate and Triethylene-Glycol-Di-2-Ethyl Hexoate.** T. K. Cox, Randallstown, Md., assignor to Western Electric Co., Inc., New York, N. Y., both in the U.S.A.

448,207. **Copolymer of 2,3-Chlorobutadiene-1,3, Butadiene-1,3 and Vinylidene Chloride.** A. M. Clifford, Stow and W. D. Wolfe, Cuyahoga, assignors to Wingfoot Corp., Akron, all in O., U.S.A.

448,208. **In Preparing Copolymers of Butadiene-1,3 and an Aliphatic Acrylonitrile by Polymerizing in a Medium Containing an Emulsifying Agent and a Peroxide Oxidant, the Step of Agitating and Heating the Reaction Mixture in a Closed Atmosphere Containing Oxygen.** W. D. Wolfe, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O., U.S.A.

448,209. **Purifying a 2-Mercaptoarylenethiazole by Treatment with Carbon Bisulfide.** H. P. Roberts, assignor to Wingfoot Corp., both of Akron, O., U.S.A.

448,210. **Improving the Workability of a Copolymer of Butadiene-1,3 and Acrylonitrile by the Inclusion of Methyl Methacrylate.** A. M. Clifford, Stow, and W. D. Wolfe, Cuyahoga Falls, assignors to Wingfoot Corp., Akron, all in O., U.S.A.

448,220. **Composition Including a Moldable Acetone-Insoluble Polymer of Vinyl Chloride, a Plasticizer for the Polymer, and Sulfur.** W. I. Taylor, Spondon, assignor to G. G. Bonard, London, administrator of the estate of H. Dreyfus, deceased, in his lifetime of London, both in England.

448,253. **Plastic Composition Including Cellulose Acetate and, as a Plasticizer, a Hexide Diester; the Acyl Radicals Are from the Group of Acyl Radicals of Acetic, Propionic and Butyric Acids.** R. M. Goepp, Jr., New Castle, Del., assignor to Atlas Powder Co., Wilmington, Del., U.S.A.

448,269. **Resinous Coating for Insulating Conductors Including Vinyl Acetate-Vinyl Chloride Copolymer, and, as Plasticizer, Hydrogenated Methyl Abietate and Dioctyl Phthalate.** A. O. Blades, Rome, N. Y., assignor to General Cable Corp., New York, N. Y., U.S.A., assignor to Canada Wire & Cable Co., Ltd., Leaside, Ont.

448,310. **Melamine Formaldehyde Molding Composition.** D. E. Cordier, assignor to Libbey-Owens-Ford Glass Co., both of Toledo, O., U.S.A.

448,315. **Thermoplastic Resin Including Polymerized 3,4 Dichlorostyrene.** J. C. Michalek, Niagara Falls, assignor to Mathieson Alkali Works, New York, both in N. Y., U.S.A.

448,349. **Cylopentadiene from Dichlorocyclopentane.** G. W. Hearne, Berkeley, and D. S. LaFrance, Richmond, assignors to Shell Development Co., San Francisco, all in Calif., U.S.A.

448,350. **Selective Hydrogenation of Cyclopentadiene to Cyclopentene.** T. W. Evans and E. C. Shokal, both of Oakland, and R. C. Morris, Berkeley, assignors to Shell Development Co., San Francisco, all in Calif., U.S.A.

448,362. **Benzene-Soluble Polymer of Cyclopentadiene.** S. G. Trepp, Swarthmore, assignor to United Gas Improvement Co., Philadelphia, both in Pa., U.S.A.

448,373. **Dry Adhesive Film from a Urea-Formaldehyde Condensation Product.** O. E. Backman, Tammerfors, Finland.

448,413. **Product of Polymerization of a Mass Including a Vinyl Halide and Toloxy Lead Oleate.** R. W. Staley, Pittsfield, Mass., U.S.A., assignor to Canadian General Electric Co., Ltd., Toronto, Ont.

448,427. **Making Highly Elastic Filaments, Threads, Yarns, and Other Textile Articles of Vinyl Resin by Treatment with an Elasticizer from the Class of Higher Alkyl Esters of Dicarboxylic Acids and the Polyglycol Esters of Carboxylic Acids.** T. A. Field, Jr., Charleston, W. Va., U.S.A., assignor to Carbide & Carbon Chemicals, Ltd., Toronto, Ont.

448,441. **Recovering Butadiene from a Mixture of Butadiene and $C_4$-Monoolefins.** D. Craig, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y., both in the U.S.A.

448,466. **Forming an Impervious, Well-Bonded Laminate by Impregnating a Fibrous Material with a Polymerizable Liquid Mixture of an Organic Peroxy Polymerization Catalyst and a Peroxide Polymerizable Polyunsaturated Liquid Ester, and Heating under Pressure.** I. E. Muskat, Plainfield, N. J., assignor to Pittsburgh Plate Glass Co., Pittsburgh, Pa., both in the U.S.A.

448,476. **Lignin Material from Black Liquor.** G. H. Tomlinson, Montreal, P.Q., and G. H. Tomlinson, Jr., Cornwall, Ont., assignors to Howard Smith Paper Mills, Ltd., Montreal, P. Q.

448,487. **Adhering a Vulcanizable Composition Surface to a Metallic Surface by Coating the Latter with a Thin Film Whose Sole Active Ingedient Is an Ester of the Group of Dibutyl Phthalate, Tricresyl Phosphate, Amyl Acetate, Ethyl Acetate, Butyl Acetate, Ethyl Acetoacetate, Methyl Benzoate, Methyl Salicylate, Triethylene, and Triethylene-Glycol-Di-2-Ethyl Hexoate.** T. K. Cox, Radallstown, Md., assignor to Western Electric Co., Inc., New York, N. Y., both in the U.S.A.

448,586. **Producing Dibenzthiazyl Disulphide by Electrolyzing an Aqueous Solution of a Sodium Salt of Mercaptobenzothiazole.** J. A. Gardiner, Llangollen, Denbighshire, Wales, assignor to Monsanto Chemicals, Ltd., London, England.

## United Kingdom

598,696. **Espansion Jointing Compositions.** C. R. De Berry.

598,777. **Polymeric Materials.** Imperial Chemical Industries, Ltd., D. Brundrit, and J. A. D. Hickson.

598,778. **Organo-Silicon Compounds.** Imperial Chemical Industries, Ltd., H. J. Emeleus, and S. R. Robinson.

598,822. **Polymerization Products.** E. I. du Pont de Nemours & Co., Inc.

598,857. **Polymers and Copolymers of Acenaphthylene.** British Thompson-Houston Co., Ltd.

598,861. **Aqueous Dispersions of Water-Insoluble Solids.** Imperial Chemical Industries, Ltd., E. Kay, and A. MacArthur.

598,871. **Oil Phase Polymerization.** United States Rubber Co.

598,890. **Polymerization Process.** Distillers Co., Ltd., J. J. P. Staudinger, and M. D. Cooke.

598,914. **Methylpentadiene Polymers.** Shell Development Co.

598,925. **Low-Temperature Polymerization of Hydrocarbons.** J. C. Arnold (Standard Oil Development Co.).

600,317. **Low-Temperature Polymerization of Olefinic Materials.** J. C. Arnold (Standard Oil Development Co.).

600,350. **Halogen Substituted Aryl Ethanes.** J. R. Geigy, A.G.

600,369. **Modifying Leather by Treatment with Sulfonated Polymeric Materials.** E. I. du Pont de Nemours & Co., Inc., M. T. Goebel, and J. S. Kirk.

600,403. **Plastic Compositions.** E. da Fano.

600,408. **Synthetic Resinous Condensation Products.** Beck, Koller & Co. (England), Ltd., E. A. Bevan, and R. S. Robinson.

600,473. **Films of Resin or Other Plastic Materials.** Wingfoot Corp.

600,490. **Solutions of Polyvinyl Derivatives.** Soc. Rhodiaceta.

600,569. **Cation Exchange Resins.** American Cyanamid Co.

600,618. **Synthetic Resinous Condensation Products.** Beck, Koller & Co. (England), Ltd., E. A. Bevan, and R. S. Robinson.

600,644. **Cold Setting Thioplast Compositions.** Dunlop Rubber Co., Ltd., and M. Goldstaub.

600,662. **Synthetic Resins and Stoving Enamels.** D. H. and S. R. Finn and R. M. A. Welchman.

600,708. **Stabilization of Acrylonitrile against Deterioration.** American Cyanamid Co.

600,718. **Thermosetting Resins.** Westinghouse Electric International Co.

600,763. **Coatings and Adhesive Compositions Containing Synthetic Resins.** W. Blackman and J. E. S. Whitney.

600,765. **Interpolymers of Vinyl Aromatic Compounds.** A. H. Stevens (Monsanto Chemical Co.).

600,775. **Corrosion Protective Compositions.** Shell Development Co.

600,782. **Polymers.** B. F. Goodrich Co.

600,800. **Compositions Containing Synthetic Resins for Use as Cements, Coatings, or the Like.** W. Blackman and J. E. S. Whitney.

600,904. **Vinyl Halide Resins.** Distillers Co., Ltd., J. J. P. Staudinger, and B. K. Kelly.

600,905. **Polymerization Reactions.** Distillers Co., Ltd., J. J. P. Staudinger, and M. D. Cooke.

600,916. **Alkyl Ester Copolymers.** American Cyanamid Co.

600,917. **Emulsion Polymerization.** American Cyanamid Co. and E. L. Kropa.

600,924. **Resin Emulsions.** Johnson & Johnson (Great Britain), Ltd.

600,950. **Vinyl Halide Resins.** Distillers Co., Ltd., J. J. P. Staudinger, and B. K. Kelly.

600,988. **Chlorinated Rubber Adhesives.** Firestone Tire & Rubber Co.

600,989. **Treatment of Chlorinated Rubber Derivative.** Firestone Tire & Rubber Co.

601,101. **Synthetic Resins.** T. Urbanski.

601,114. **Chlorinated Products of Carboxylic Acid Esters.** Ridbo Laboratories, Inc.

601,123. **Synthetic Linear Condensation Polymers.** J. Lincoln.

601,191. **Polymerization of Vinyl Acetate in Emulsion.** Distillers Co., Ltd., D. Cleverdon, and J. J. P. Staudinger.

601,223. **Polymerization of Butadiene-1,3 Hydrocarbons and the Polymerization of Mixtures of Copolymerizable Unsaturated Organic Compounds at Least One of Which Is a Butadiene-1,3 Hydrocarbon in Aqueous Emulsion.** B. F. Goodrich Co.

601,224. **Hydrocarbon Copolymers.** J. C. Arnold (Standard Oil Development Co.).

601,293. **Coagulation of Emulsion Polymers.** Wingfoot Corp.

# MACHINERY

## United States

2,440,740. **Pneumatic Tire Spreader.** P. Daddio, New York, N. Y.

2,441,097. **Plastics Molding Apparatus.** J. S. Hicks, Toledo, O., assignor to Owens-Corning Fiberglass Corp., a corporation of Del.

2,441,118. **Apparatus for the Manufacture of Seamless Varicose-Vein Stockings.** L. Boucrout, assignor to Les Fils de Valton & Co., both of Troyes, France.

2,441,222. **Worm-Type Extruder.** L. J. Fuller, assignor to Welding Engineers, Inc., both of Philadelphia, Pa.

2,441,235. **Apparatus to Make Sponge Rubber Articles.** G. W. Blair, W. J. Clayton, E. H. Clark, and J. F. Schott, all of Mishawaka, Ind., and A. W. Keen, Packanack Lake, N. J., assignors to United States Rubber Co., New York, N. Y.

2,441,548. **Mold for High-Frequency Curing of Foamed Latex.** J. A. Sperry, Tallmadge, assignor to Baker, McMillen Co., Akron, both in O.

2,441,757. **Apparatus to Cut and Impress Sheets of Plastic Material.** C. and H. H. Doering, E. W. Anderson, and B. J. Skoglund, all of Chicago, Ill., Anderson and Skoglund assignors to C. and H. H. Doering.

2,441,904. **Device to Heat-Seal Plies of Saran Film.** H. A. Rohdin, Glen Ridge, assignor to Packaging Industries, Inc., Montclair, both in N. J.

## Dominion of Canada

448,088. **Machine to Make Flexible Airproof Packages.** L. L. Salfisberg, South Orange, N. J., U.S.A.

448,109. **High-Frequency Heating Device for Insulating Material.** J. C. Quayle, Helsby, and P. Jones, Kelsall, assignors to British Insulated Cables, Ltd., Prescot, in liquidation by D. McKellar, Liquidator, assignor to British Insulated Callender's Cables, Ltd., London, all in England.

448,212. **Fluid Flow Control Device.** H. R. Miller, Marshalville, assignor to Wingfoot Corp., both in O., U.S.A.

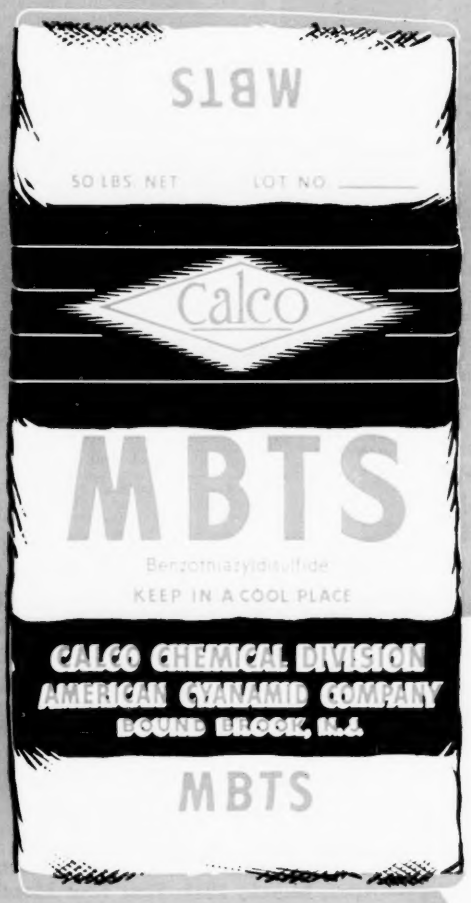
448,298. **High-Frequency Heating Apparatus for Continuous Heating of a Thread of Dielectric Material.** E. T. Hsu, assignor to General Electric Co., both of Schenectady, N. Y., U.S.A.

448,440. **Apparatus to Form a Package by Blowing a Bubble of Thermoplastic Material.** M. Wagner, assignor to Glenside Bag Co., both of Glenside, Pa., U.S.A.

448,454. **Control Apparatus for Vulcanizing Press.** L. E. Soderquist, assignor to McNeil Machine & Engineering Co., both of Akron, O., U.S.A.

448,455. **Vulcanizing Press.** L. E. Soderquist, assignor to McNeil Machine & Engineering Co., both of Akron, O., U.S.A.

448,496. **Device for Applying a Bead to a**

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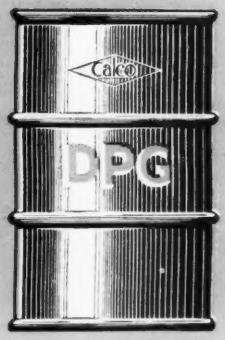


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RUBBER CHEMICALS DEPARTMENT

**CALCO CHEMICAL DIVISION**

**AMERICAN CYANAMID COMPANY**

BOUND BROOK • NEW JERSEY

Calco

REG. U.S. PAT. OFF.

**SALES REPRESENTATIVES AND WAREHOUSE STOCKS:** Akron Chemical Company, Akron, Ohio • Ernest Jacoby & Company, Boston, Mass. • Herron & Meyer of Chicago, Chicago, Ill. • H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J. • In Canada: St. Lawrence Chemical Company, Ltd., Montreal and Toronto.

**Cylindrical Body.** H. E. Smith, Newark, N. J., assignor to C. Dreyfus, New York, N. Y., both in the U.S.A.

448,616. **Mold Element for Forming a Plastic Cap.** A. B. McGinnis, assignor to Wheeling Stamping Co., both of Wheeling, W. Va., U.S.A.

### United Kingdom

598,910. **Electric Hot Plates for Heating Molds Containing Plastic Materials.** J. Finney and G. E. Moore.

## UNCLASSIFIED

### United States

2,440,804. **Wheel Structure.** G. A. Lyon, Allenhurst, N. J.

2,440,858. **Wheel Structure.** C. Hollerith, Jackson, Mich., assignor, by mesne assignments, to B. F. Goodrich Co., New York, N. Y.

2,440,863. **Tire Anti-Skid Device.** L. L. Liggio, Yonkers, N. Y.

2,441,009. **Tank Fitting.** M. M. Cunningham, South Bend, Ind., assignor to United States Rubber Co., New York, N. Y.

2,441,075. **Coupling.** J. T. Krapp, Port Washington, N. Y.

2,441,429. **Anti-Skid Device.** M. T. Masure, Feeding Hills, Mass.

2,441,670. **Tire-Skid Device.** J. A. Morrone, assignor to Morrone Mfg. Co., both of Westerly, R. I.

2,441,718. **Two-Piece Hose Coupling.** A. L. Parker and J. N. Wolfram, assignors to Parker Appliance Co., all of Cleveland, O.

2,441,735. **Cleat Chain for Pneumatic Tires.** R. W. Turk, Finlayson, Minn.

2,441,821. **Machine to Apply Adhesive Tape to a Sheet and Punch the Sheet.** H. G. Kendall, Brooklyn, N. Y., assignor of one-half to G. H. Fritzinger, West Orange, N. J.

2,442,034. **Pipe Coupling.** F. B. Busch, Toledo, O.

2,442,063. **Stripping Knife for Electric Cables.** D. D. Stone, Quincy, Mass.

2,442,104. **Device for Indicating Underinflation of Tires.** H. D. Twombly, assignor of one-half to F. G. Grimes, both of Portland, Oreg.

2,442,193. **Joint for Electric Cables.** L. G. Brazier, assignor to British Insulated Callender's Cables, Ltd., both of London, England.

2,442,322. **Anti-Skid Device.** F. J. Daley, Schenectady, N. Y.

### Dominion of Canada

448,075-076. **Wheel Structure.** G. A. Lyon, Allenhurst, N. J., U.S.A.

448,131. **Apparatus for Treating Yarn to Increase Its Tensile Strength.** A. W. Hansen, Jackson Heights, N. Y., and A. N. Benson, Des Moines, Iowa, both in the U.S.A., assignors to Dominion Rubber Co., Ltd., Montreal, P.Q.

448,184. **Inflating Valve for Hollow Articles.** B. A. McDermott, Akron, assignor to Sun Rubber Co., Barberton, both in O., U.S.A.

448,211. **Treating an Impingement Carbon Black.** E. Bristol, assignor to Wingfoot Corp., both of Akron, O., U.S.A.

448,235. **Flexible Coupling.** E. Hagenlocher, Warren, Pa., U.S.A.

448,258. **Preparing Sterile Thin-Walled, Tubing Collapsible under Atmospheric Pressure.** N. M. Nesset, Glenview, and E. J. Nawoj, Chicago, assignors to Baxter Laboratories, Inc., Glenview, both in U.S.A.

448,365. **Spare Tire Carrier Skid Assembly.** P. J. Huebshman, Dearborn, assignor to Whitehead & Kales Co., Detroit, both in Mich., U.S.A.

### United Kingdom

600,812. **Fluid-Operated Expanders Suitable for Brakes and Clutches.** B. F. Goodrich Co.

## TRADE MARKS

### United States

438,564. Representation of a retort containing representations of a rubber plantation and a factory. Adhesives, cements, and bonding agents. Industrial Adhesives, Inc., Cincinnati, O.

438,572. Representation of a rectangle containing a fanciful outline of a man. Adhesives. Park Leggett Altman Co., Minneapolis, Minn.

438,602. **Patchlast.** Cement. H. B. Kuhls, Brooklyn, N. Y.

438,611. **Finger-Tip.** Tire chain fasteners. St. Pierre Chain Corp., Worcester, Mass.

438,615. Representation of a diamond containing the word: **"Amity."** Elastic. Amity Notion Co., Inc., New York, N. Y.

438,632. Representation of an oval containing the words: **"Seamless First Quality Since 1817"** and another oval containing the letters: **"SR."** Combs. Seamless Rubber Co., New Haven, Conn.

438,701. **Duraplex.** Synthetic resinous materials for use in the manufacture of paints, varnishes, lacquers, adhesives, and printing inks. Resinous Products & Chemical Co., Philadelphia, Pa.

438,704. **Resproofed.** Impregnated fabrics. Respro, Inc., Cranston, R. I.

438,743. **M AND R.** Tire mounters and demounters. M & R, Yuba City, Calif.

438,755. **Gentleform.** Garter belts, girdles and foundation garments. Lagnon Mfg. Ltd., Toronto, Ont., Canada.

438,756. **Gentleflex.** Garter belts, girdles, and foundation garments. Lagnon Mfg. Ltd., Toronto, Ont., Canada.

438,774. **Inertol.** Waterproofing and protective coatings. Inertol Co., Inc., Newark, N. J.

438,803. **"In The Bag."** Raincoats. M. Breier's Sons, New York, N. Y.

438,805. **Excelsior.** Trusses. Ohio Truss Co., now by change of name, Surgical Appliance Industries, Inc., a corporation of O.

438,807. **Handi-Mite.** Dish-washer appliance hose. L. K. Franklin Corp., Los Angeles, Calif.

438,826. **Contact.** Pressure-sensitive labels. Contact Products, Inc., Los Angeles, Calif.

438,855. **Amberlite.** Synthetic resinous materials for use in adhesives. Resinous Products & Chemical Co., Philadelphia, Pa.

438,872. Representation of a circle containing the letters: **"RCA."** Rubber feet for cabinets. Radio Corp. of America, New York, N. Y.

438,875. **Grip-Tite.** Adhesives. Lino Paste Co., Inc., Chicago, Ill.

438,889. **Arosil.** Organosilicon compounds. U. S. Industrial Chemicals, Inc., New York, N. Y.

438,897. **Flexa-Belle.** Waterproof sheeting. A. Beir & Co., Inc., New York, N. Y.

438,916. **Code T-52.** Camelback. Gates Rubber Co., Denver, Colo.

438,960. **Water-Wings.** Swimming supports. Ayvad Water-Wings, Inc., Union City, N. J.

500,239. **Syn-Tac.** Plasticizer, tackifier, and extender. C. P. Hall Co., Akron, O.

500,247. **Para Resin.** Plasticizer and extender. C. P. Hall Co., Akron, O.

500,277. Representation of a cup and the words: **"Gold Cup."** Solvent. Dunlop Tire & Rubber Corp., Buffalo, N. Y.

500,368. **Sirez.** Synthetic resins. Monsanto Chemical Co., St. Louis, Mo.

500,390. **Aqua=Shade.** Waterproofed shade cloth. Interstate Shade Cloth Co., Hoboken, N. J.

500,396. **USACO.** Clutch facings and brake linings. Raybestos-Manhattan, Inc., Passaic, N. J.

500,414. **Rhonite.** Powdered synthetic resins and solutions thereof. Rohm & Haas Co., Philadelphia, Pa.

500,441. **Raintwil.** All-cotton twill with water repellent finish. C. S. Brown & Co., Inc., New York, N. Y.

500,452. **Dermatape.** Adhesive surgical strips. J. D. Reese, Philadelphia, Pa.

## Trade Lists Available

The Commercial Intelligence Division, United States Department of Commerce, Washington, D. C., recently compiled the following trade lists, of which mimeographed copies may be obtained by American firms interested in the Division and from Department of Commerce field offices at $1 a list for each country.

Aircraft and Aeronautical Supplies and Equipment Importers and Dealers—Costa Rica; France; Sweden; Chile.

Automotive Equipment Importers and Dealers—Netherlands West Indies; Peru; Italy.

Automotive Product Manufacturers—Canada; New Zealand; Spain; Uruguay; Brazil; France.

Boot and Shoe Importers and Dealers—Netherlands West Indies; Siam.

Boot and Shoe Manufacturers—Turkey; Australia; Dominican Republic; Siam.

Chemical Importers and Dealers—Portugal.

Chemical Manufacturers—Belgium.

Dental Supply Houses—Belgium; Canada; Nicaragua.

Electrical Supply and Equipment Importers and Dealers—Roumania; China; Hungary.

Office Supplies and Equipment Importers and Dealers—Bahamas.

Mechanical Rubber Goods Importers and Dealers—Netherlands.

Plastic Materials Manufacturers, and Molders, Laminators, and Fabricators of Plastic Products—Finland.

Rubber Stamps and Stencils (Mimeograph) Manufacturers—Netherlands; Sweden.

Sporting Goods Importers and Dealers—Philippine Republic.

## Estimated Automotive Pneumatic Casings and Tube Shipments, Production, and Inventory—April, March, 1948: First Four Months, 1948-47

| | 1948 | | | | |
|---|---|---|---|---|---|
| | April | % of Change from Preceding Month | March | First Four Months | 1947 First Four Months |
| *Passenger Casings* | | | | | |
| Shipments | | | | | |
| Original equipment | 1,764,982 | | 1,860,599 | 7,068,355 | 6,366,597 |
| Replacement | 4,032,109 | | 2,643,772 | 11,831,570 | 17,353,200 |
| Export | 54,535 | | 50,932 | 260,858 | 508,382 |
| TOTAL | 5,851,626 | +28.4 | 4,555,303 | 19,160,783 | 24,288,179 |
| Production | 5,372,651 | − 5.17 | *5,665,656 | 22,586,984 | 27,002,089 |
| Inventory end of month | 8,858,055 | − 4.80 | *9,304,281 | 9,858,055 | 4,399,795 |
| *Truck and Bus Casings* | | | | | |
| Shipments | | | | | |
| Original equipment | 499,934 | | 505,191 | 1,911,670 | 2,045,587 |
| Replacement | 599,489 | | 539,467 | 2,303,134 | 3,230,927 |
| Export | 87,517 | | 102,694 | 390,995 | 519,188 |
| TOTAL | 1,186,940 | + 3.45 | 1,147,352 | 4,605,799 | 5,795,702 |
| Production | 1,201,083 | − 5.00 | *1,264,297 | 5,153,019 | 6,331,646 |
| Inventory end of month | 2,082,228 | + 1.11 | 2,059,378 | 2,082,228 | 1,208,352 |
| *Total Automotive Casings* | | | | | |
| Shipments | | | | | |
| Original equipment | 2,264,916 | | 2,365,790 | 8,980,025 | 8,412,184 |
| Replacement | 4,631,598 | | 3,138,239 | 14,134,704 | 20,584,127 |
| Export | 142,052 | | 153,626 | 651,853 | 1,027,570 |
| TOTAL | 7,038,566 | +23.43 | 5,702,655 | 23,766,582 | 30,023,881 |
| Production | 6,573,734 | − 5.14 | *6,929,953 | 27,740,003 | 33,333,735 |
| Inventory end of month | 10,940,283 | − 3.73 | *11,363,659 | 10,940,283 | 5,608,148 |
| *Passenger and Bus and Truck Tubes* | | | | | |
| Shipments | | | | | |
| Original equipment | 2,264,095 | | 2,362,681 | 8,972,281 | 8,409,079 |
| Replacement | 3,455,577 | | 2,731,033 | 11,711,166 | 16,026,639 |
| Export | 86,870 | | 94,260 | 365,849 | 941,522 |
| TOTAL | 5,806,542 | +11.92 | 5,187,974 | 20,652,296 | 25,377,240 |
| Production | 5,578,459 | + .80 | *5,534,053 | 22,317,772 | 31,143,631 |
| Inventory end of month | 9,737,206 | − 1.94 | 9,930,012 | 9,737,206 | 9,479,659 |

*Revised.

NOTE: Cumulative data on this report include adjustments made in prior months.

SOURCE: The Rubber Manufacturers Association, Inc.

# SHELL DUTREX 15

## Modified Asphaltic-Type Softener for GR-S and Natural Rubber Friction and Tread Stocks

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**SHELL OIL COMPANY, INCORPORATED**

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*(Pacific Coast Territory)*

SHELL OIL COMPANY OF CANADA, LTD., 25 ADELAIDE ST., EAST TORONTO, CANADA

# OTS Bibliography Reports on Rubber Products—XIII

*THE abstracts given below are taken from the United States Department of Commerce's weekly publication, "Bibliography of Scientific and Industrial Reports." Copies of the complete reports, either on microfilm or as photostats, as indicated, may be obtained from the Office of the Publication Board, Department of Commerce, Washington 25, D. C.*

**Redox Systems in Emulsion Copolymerization of Butadiene and Styrene.** J. M. Kolthoff. (FIAT Final Rpt. 898.) PB-44652. August, 1946. 10 pages. Photostat $1; microfilm $1. Part I of the report deals with systems containing oxygen as the oxidizing agent, and Part II deals with systems containing benzoyl peroxide as the oxidizing agent. From a practical viewpoint the most desirable redox system is that which contains traces of oxygen. The amount of air dissolved in the aqueous phase is sufficient to yield rapid polymerization. The I. G. Leverkusen group recommends mersolate as emulsifying agent, and sulfinate as reducing agent. The best pH is at about 2.5-3. At 40° C. a conversion of 60-80% is obtained in one hour. Diproxid retards the recipe. Polymerizations with benzoyl peroxide instead of oxygen are undesirable. The residual peroxide is precipitated with the coagulated polymer and affects the heat breakdown of the rubber.

**Sulfur Atoms as Softening Agents for Synthetic Rubber.** Karl Loffler. PB-56844. September, 1944. 16 pages. Microfilm $1; enlargement print $2. Sulfur atoms can be present in an ester either in its acid or alcohol component. They gained importance as softening agents for Igelit, a synthetic material. Various derivations were prepared and tested to find the most suitable combinations for esters. The action of the resultant molecules will be studied separately.

**Analytical Procedures for Determining Extent of Polymerization of Different Butadiene Polymers, Especially Buna S and SS.** Kuppe. PB-43452. February, 1943. 28 pages. Photostat $2; microfilm $1. This report describes analytical methods and results of tests performed (1) to determine the quantities of styrene present and how much of it is incorporated in Buna S and SS; and (2) to study the synthesis of the various butadiene polymers and of the butadiene component in Buna S and SS.

**Buna—Development of Manufacture.** Alt. PB-L-60283. September, 1943. 4 pages. Photostat $1; microfilm $1. This document gives a general survey of the developments in wartime Buna manufacture.

**Plastic Materials—Development of Manufacture.** Alt. PB-L-58999. September, 1943. 5 pages. Photostat $1; microfilm $1. This report sketches the development in product and capacity of the following plastic materials: acrylesters, Acronals Lu, vinyl acetates, Mowiliths Ho, vinyl chlorides, Igelits, styrenes, polystyrenes, vinyl ethers, Igerins, Oppanol B, and Igamides.

**A Study of Combinations of Neoprene with Reclaimed CWS Rubber Scrap and with Ground CWS Neoprene Scrap.** J. Gregory. PB-L-78654. March, 1944. 15 pages. Photostat $1; microfilm $1. An investigation was made on incorporating reclaimed CWS rubber scrap or ground CWS neoprene scrap in neoprene faceblank formulations. It was found possible to incorporate up to 45 parts by weight of reclaimed CWS scrap or up to 55 parts by weight of ground CWS neoprene scrap per 100 parts of neoprene for this purpose.

**The Chemical and Technical Basis for the Synthesis of Butadiene at I. G. Ludwigshafen.** George Nieman and others. PB-L-60574. (FIAT Rpt. 1003.) April, 1947. 31 pages. Mimeographed $1. This is a lecture given by Dr. Nieman on May 12, 1944. The author compares briefly two butadiene processes based on acetylene: (1) via acetaldehyde by addition of water, and (2) via butynediol from reaction with formaldehyde. Flowsheets of the latter process are given. Mention is also made of numerous products that can be made from intermediates and side products of the process.

**Buna—Technique in Its Use.** Konrad and Ludwig. PB-L-60282. September, 1943. 6 pages. Photostat $1; microfilm $1. This report reviews briefly the technical uses and applications of various types of Buna, Buna copolymers, Buna plasticizers, and Buna resins. A brief note on Buna auxiliary products is included.

**Acrylonitrile.** I. G. Farbenindustrie A. G. PB-L-35033. (Part of PB-13321.) 1940-1945. 13 frames. Microfilm $1; enlargement print $1.50. This is a patent application on a process for separation of acrylonitrile. With the help of acetylene polymerizing catalysts, hydrocyanic acid is added to acetylene. Among the various by-products divinylacetylene is difficult to remove. To obtain a divinylacetylene-free acrylonitrile, the gas mixture is washed with a solvent, preferably water, and the acrylonitrile separated by fractional distillation. A second patent application deals with a process for production of acrylonitrile from acetylene and hydrogen cyanide. For this purpose formamide or hydrogen cyanide and steam are reacted with acetylene at higher temperatures, preferably 200-450° C., in the presence of catalysts.

**Preparation of Vinyl Methyl Ketone.** Cornelius Mulhausen. PB-L-35038. (Part of PB-13321.) May, 1940. 3 frames. Microfilm $1; photostat $1.50. Experiments were carried out to obtain vinyl methyl ketone by dehydration of 2,3- and 2,4-ketobutanol. Only dehydration of 2,4-ketobutanol gave good yields. Starting material for the preparation of 2,4-ketobutanol could be 1,3-butylene glycol which is dehydrated in the presence of an all-metal catalyst made of copper, preferably a mixture of copper and copper oxide. (In German.)

**Controlled Polymerization of Resins; Polyacrylamide.** Meisenburg. PB-L-35047. (Part of PB-13321.) January, 1942. 3 frames. Microfilm $1; enlargement print $1.50. This is report No. 125 of the I. G. rubber laboratory, dated January 27, 1942. The following agents proved good polymerization regulators: (1) the addition product of para-thiocresol and butadiene; (2) ditolyl disulfide and octadecyl mercaptan. Various experiments were conducted on the polymerization of acrylamide with benzoyl peroxide, but these polymers were inferior to those of absolutely pure acrylamide in the presence of traces of potassium persulfate. (In German.)

**Polyacrylamide.** Meisenburg. PB-L-35050. (Part of PB-13321.) February, 1941. 1 frame. Microfilm $1; enlargement print $1.50. This is report No. 116 of the I. G. rubber laboratory, dated February 25, 1941. Polyacrylamide was polymerized in water, glycerol, and a mixture of water and glycerol. If, instead of glycerol trimethylol, propane was used for the polymerization, then soft and wax-like polymers were obtained. The polymerization of acrylamide in organic solvents depends greatly on its purity. (In German.)

**Latex Aids.** I. G. Farbenindustrie, Leverkusen. PB-L-35114. (Part of PB-13321.) October, 1942. 3 frames. Microfilm $1; enlargement print $1.50. Use of Emulgator MN as a plasticizer for Igetex mixtures (Buna latices) is more economical than that of Emulphor O. 1-3% solutions of the new emulsifying agent are sufficient; whereas Emulphor O solutions require a concentration of 10-20%. As Latekoll A cannot be used for Ingetex N mixtures which contain zinc oxide, another thickening agent, Latekoll N, is recommended. The compositions of the new agents are not given. (In German.)

**Determination of Small Amounts of Amine in Butadiene.** Braucker. PB-L-35143. (Part of PB-13321). January, 1943. 2 frames. Microfilm $1; enlargement print $1.50. The method consisted of evaporating the butadiene, passing it through hydrochloric acid, and measuring the amount of nitrogen in the hydrochloric acid by the Kjeldahl method. A table lists results with various butadiene mixtures. (In German.)

**Stabilizing Agents in Buna S.** Hagen. PB-L-35137. (Part of PB-13321.) October, 1939. 4 frames. Microfilm $1; enlargement print $1.50. This is an evaluation of a number of amine and diamine derivatives tested as stabilizers. Two tables list 15 stabilizers and their effects. (In German. Will not reproduce well.)

**Rubber Vulcanization Accelerators Produced by I. G. Farbenindustrie A. G. at Hochst, Elberfeld, and Leverkusen.** Coleman J. Major. PB-L-78997. (FIAT Rpt. 1018.) April, 1947. 91 pages. Mimeographed $2.50. Process details have been obtained for the manufacture of 22 rubber vulcanization accelerators. These are Vulkacit AZ, BZ, CA, CT, CT-N, D, DM, DOTG, F, FP, H, I, M, P, P Extra N, Thiuram, U, 576, 576 Extra, 774, and 1000. Flow sheets appear in the text, and diagrams of apparatus are attached.

**Styrene Production in Germany.** Technical Industrial Intelligence Committee. PB-L-80753. August, 1945. 22 pages. Microfilm $1; photostat $2. This report summarizes results obtained at the several German synthetic rubber plants, based on field team reports so far available. It is felt that sufficiently adequate information is now at hand to give a fairly accurate picture of the process used in Germany during the past few years. Tables appear in the report, and flow sheets are appended.

**Technical Butadiene Catalysts.** Von Susich. PB-L-81131. July 1947. 16 pages. Microfilm $1.25; photostat $2. The chemical and physical nature of the catalyst used in the production of butadiene from 1,3- and 1,4-butanediol was generally unknown. X-ray test revealed that these catalysts consist of sodium pyrophosphate and sodium metaphosphate with a small amount of free phosphoric acid. The phosphoric acid in the catalyst was in a phosphate-phosphoric acid combination difficult to detect by X-ray. The life of the catalyst was principally limited by resinification. Attempts to improve the empiric butadiene catalyst failed.

**Igetex, Synthetic Latex Supplement.** I. G. Farbenindustrie A.G. PB-L-85767. May, 1943. 17 pages. Mimeographed 50¢. This is a translation of an I. G. report which deals with: (1) behavior of Igetex vulcanizates in cold temperatures; (2) dispersion agent consumption of several fillers and other solid latex addends; (3) emulsification of liquid auxiliary products for Igetex mixes; (4) thickening of Igetex mixes; and (5) heat sensitization of Igetex S, SS, and N with Igevin M50. Several tables are included.

**Rubber Compositions Resistant to Highly Concentrated Hydrogen Peroxide.** U. S. Field Information Agency, Technical. PB-L-85151. June, 1947. 6 pages. Mimeographed 25¢. This bulletin covers the compositions of rubber mixtures used in gaskets and rings where contact with concentrated hydrogen peroxide was involved.

**Koresin Manufacture.** Buna-Werke G. M. B.H., Schkopau, and I. G. Farbenindustrie, Ludwigshafen. PB-L-85657. January, 1945. 135 pages. Microfilm $4.25; photostat $14. This report consists of letters and reports on Koresin, made by vinylation of butyl phenol in the presence of zinc naphthenate. Detailed information appears on starting materials, process, equipment, yield, cost, etc. (In German with an English summary.)

**Technical Drawings and Flow Sheets.** I. G. Farbenindustrie, Ludwigshafen. PB-L-73430. 1938-1946. 166 frames. Microfilm $2.50; enlargment print $17. This reel contains drawings of the Buna S plant at Ludwigshafen and of its equipment, and flow sheets illustrating its processes. (In German).

**Production Process of Butynediol.** Trieschmann. PB-L-35169. (Part of PB-13322.) July 1944. 7 frames. Microfilm $1; enlargement print $1.50. This is a detailed report on the production of butadiene from butyne-1,4-diol (from acetylene and formaldehyde) as carried out at Ludwigshafen. Special attention is given to the treatment of the catalyst, the concentrations of formaldehyde and acetylene, the distillation of propargyl alcohol, and other technical measures. (In German.)

**Special Characteristics of Reppe's Butadiene Process.** Reppe. PB-L-35220. (Part of PB-13322). July, 1944. 9 frames. Microfilm $1; enlargement print $1.50. This report gives a detailed description of the chemistry of the reaction, the catalysts, the plant layout, and the plant operation. Two diagrams are included. (In German.)

*(To be continued)*

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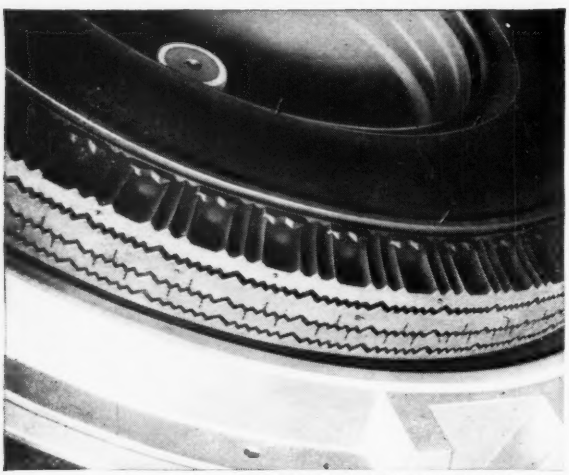

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Lower maintenance and operating costs, reduced scrap and improved finish are among the advantages of DC Mold Release Fluid realized by rubber companies in all parts of the world. These advantages have resulted in a steadily increasing demand that has enabled us to produce larger quantities of DC Mold Release Fluid at a lower unit cost. We are passing these savings on to you in a new price reduction amounting to 9 per cent.

Price, however, is relatively unimportant compared with savings in production costs and improved quality resulting from use of DC Mold Release Fluid. In molding automobile and tractor tires, for example, Dunlop Tire and Rubber Corporation of Buffalo, New York, sprays a dilute solvent solution of DC Mold Release Fluid on the surface of talc-free green tires. After more than three months of operation, the molds are essentially as clean as they were when first placed in service and a major source of dust and dirt in the plant has been removed.

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FOR use wherever there is need of a quick-opening door on a pressure or vacuum vessel, either vertical or horizontal type, is the Harris quick-opening safety door, built by United Welding & Mfg. Co., Los Angeles, Calif. The door differs from conventional types in that the sealing mechanism is a free-moving, rotating, indexing ring mounted on bearings. It requires no special tools, gears, or hand wrenches and has no threaded parts.

A simple two-step operation opens the door. A breaker bar inserted in a leverage slot on the indexing ring turns the ring enough to crack the door and dissipate any remaining pressure while leaving the door still engaged. One further movement of the indexing ring permits the door to swing free. Closing the door is even simpler; the indexing ring is turned to a locked position in one movement. The door is available with a short section of shell ready to attach to existing vessels, or as part of a complete vessel. Of all-welded steel construction, the door is built to code specifications and is available in both round and rectangular models.

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THE Mickro-Samplmill, a new mill for laboratory use in the grinding of analytical samples, is being marketed by Pulverizing Machinery Co., Summit, N. J. The mill is furnished

Mikro-Samplmill Laboratory Pulverizer (Floor Model) with Grinding Chamber Open

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in two models for bench and floor use. Although designed primarily for analytical samples, the mill performs with equal efficiency on limestone, coal, and other minerals, as well as on a wide range of chemicals, pigments, food products, and other materials.

Complete protection against contamination is accomplished by liberal use of stainless steel and by smooth interior surfaces. Complete and thorough cleaning between batches is generally a matter of only one minute or two minutes, depending on the nature of the material ground. A clean-out door in the mill housing enables the operator easily to brush residues from under the screen into the glass discharge jar. The grinding chamber is readily accessible by means of a hinged cover. The one-piece rotor, screen, and feed screw can be removed, cleaned, and replaced very easily and quickly. Although feed rate varies with nature of material and fineness of grind, it will approximate one pound a minute.

The normal speed of the mill is 3,000 r.p.m., but an extra pulley is included for 12,000 r.p.m. operation for use with tough or resistant material. The mill is furnished with screens having 0.039-, 1/16-, and 1/8-inch perforations, and other-size screens are available from stock.

**Weston Relative Humidity Indicator with Direct-Reading Scale**

## Humidity Indicator for Industry or Laboratory

A NEW, quick-reading, all-metal humidity indicator for use in industry or in the laboratory provides readings of relative humidity accurate within ±1% for general conditions, it is claimed. The instrument is of wet and dry bulb type, featuring all-metal Weston laboratory thermometers, self-supporting wet bulk wick covering the thermal element, sturdy all-metal construction, and a simplified slide rule calculator giving direct readings of relative humidity and eliminating the need of tables or psychrometric charts. The only maintenance required is to change the wick occasionally and replenish the water in the reservoir.

The slide rule calculator, located on the face of the instrument directly beneath the thermometers, indicates relative humidity from 10 to 100% and requires no calibration. When the calculator has been set according to the readings of the two thermometers, the relative humidity can be read directly from the upper scale of the calculator. Weston Electrical Instrument Corp., Newark, N. J.

**"Carbon Black Chart."** Witco Chemical Co., 295 Madison Ave., New York 17, N. Y. This folder lists the names and suppliers of carbon blacks used in rubber, paints, and other products, and gives data on the physical and chemical properties of Witco and Continental Carbon Co. blacks

# STAMFORD "FACTICE" VULCANIZED OIL

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Our products are engineered to fill every need in natural and synthetic rubber compounding wherever the use of vulcanized oil is indicated.

We point with pride not only to a complete line of solid Brown, White, "Neophax" and "Amberex" grades, but also to our aqueous dispersions and hydrocarbon solutions of "Factice" for use in their appropriate compounds.

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The services of our laboratory are at your disposal in solving your compounding problems.

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**JEFCO JUTE TUBING** is available in widths to fit a wide assortment of package sizes and shapes. Write for complete information today!

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## ATLAS Type "E"

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This valve performs so well because it is modern in every detail. The body, for example, is of forged steel. The internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

*For other ATLAS rubber plant products see the partial list in our ad in the January, 1948, issue of INDIA RUBBER WORLD*

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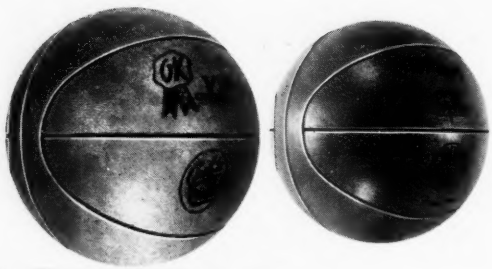


Ohio-Kentucky's New Basketballs

### Molded Basketballs

OHIO-KENTUCKY MFG. CO., Ada, O., has announced the VB Official and CB Official basketballs as additions to its Craft-Built line of basketballs, footballs, soccer balls and volley balls.

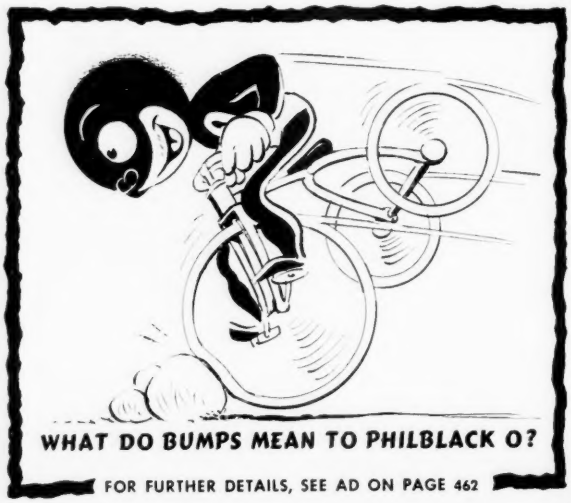
The VB Official is an all-rubber ball designed and constructed to give exceptional wear on the outdoor court. The ball, it is claimed, has a tough rubber cover that will not scuff or tear in service on concrete, gravel, or cinder floors. To assure ease in handling, the ball has a new pebble finish which has both the appearance and feel of leather.

The CB Official basketball has a leather cover molded to a rubberized carcass. The leather is vulcanized to the carcass, making separation or peeling impossible. The ball has no exposed seams to reduce wear, and is said to be the first molded basketball having a simple four-piece leather construction. The CB ball is guaranteed to hold its true spherical shape and it gives consistent rebound at all times.

### Rubber Toys in Attractive Sets

THE Auburn Rubber Corp. is producing a new series of rubber toys and toy sets that are proving extremely popular with children. One of these is a line of three-, four-, five-, and six-inch gas-inflated rubber playballs in attractive four-color designs, including alphabets, clowns, animals, and other juvenile favorites. The balls have a white background, red and blue contrasting colors for the design, and a gold band and are high bouncers.

Another new item is a rubber team and wagon, consisting of a brown-colored team of horses and black harness hitching to a red wagon and tongue. Both the team and the wagon are mounted on




FOR FURTHER DETAILS, SEE AD ON PAGE 462

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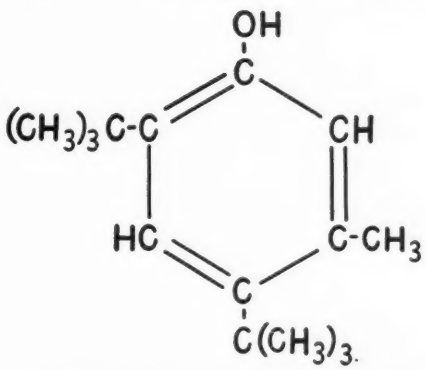

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***This interesting alkylated phenol undergoes the reactions shown below:***

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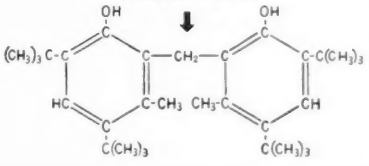
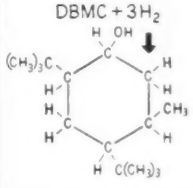


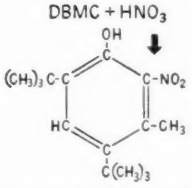
Hydrogenation

DBMC + $3H_2$



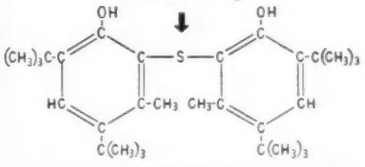
Nitration

DBMC + $HNO_3$



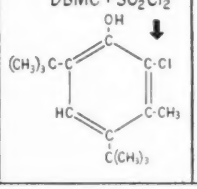
Sulfurization

2 DBMC + $SCl_2$



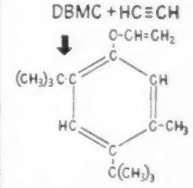
Chlorination

DBMC + $SO_2Cl_2$



Vinylation

DBMC + HC≡CH



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LABORATORY MILLS

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**RMP**

**ANTIMONY**

**FOR RED RUBBER**

. . . . The utmost in pleasing appearance with no deteriorating effect whatever.

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**RARE METAL PRODUCTS CO.**
**ATGLEN, PA.**

**New Auburn Rubber Toys, Including Team and Wagon, Play Ball, and Fire Engine Set**

wheels and have a combined length of more than 13 inches.

The company also is featuring three rubber toy sets. The first, the fire engine set, consists of one 7¾-inch fire hose wagon, one 5½-inch pumper, one four-inch motorcycle policeman, one 4¾-inch chief's car, and two three-inch firemen. The carry car set, the second item, comprises a 12-inch long carry car transport and two small automobiles that fit on to the transport. The third set, the auto set, consists of a large-size fire engine, an automobile, the carry car trailer, a medium-size truck, and a small-size rubber tractor. These sets all consist of realistic scale model toys which have added play value in addition to the safety and cleanliness qualities inherent in all-rubber construction.

**Goodyear's New Plastic Hose**

## Garden Hose Made of Vinyl

VINYL garden hose, a plastic hose said to be extremely light in weight and flexible, has been added to the conventional line made by the mechanical goods division, Goodyear Tire & Rubber Co., Akron, O. Produced in two colors, red and green, and attractively packaged, the new hose is expected to appeal to women. Made in 25- and 50-foot lengths, the hose comes complete with couplings.

**"The Neoprene Latices."** E. P. Hartsfield and J. R. Galloway. Report No. 48-1, June, 1948. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 6 pages. This booklet describes the different neoprene latices currently available and tabulates the properties of the latices and their derived films.

# FAR EAST

## FEDERATION OF MALAYA

The above caption indicates the new status of the territory which before the war was known as British Malaya. After the liberation the Malayan Union was formed—too hastily, as it turned out, for it proved most unpopular. The Federation of Malaya was formally inaugurated on February 1, 1948, with the aim of bringing genuine democracy to the peninsula. Sir Edward Gent was installed as First High Commissioner.

### Singapore Chamber of Commerce Rubber Association

At the general meeting of the Singapore Chamber of Commerce Rubber Association held at the end of March, the deputy chairman, I. G. Salmond, remarked on the improvement of the Singapore labor situation in 1947 as compared with 1946, but warned that it would be foolish to view the 1947 period with complacency. Labor is now very definitely socially conscious, he added, and the demands of the various trade unions, which still require education in union practice, are frequently irresponsible and most difficult of settlement. He then mentioned a "go-slow" movement among labor in Singapore which was seriously affecting the remilling factories here. Singapore, it may be recalled, is the center of the Malayan rubber remilling industry and has 13 mills with a monthly capacity of 20,000 tons.

Incidentally, millers have been complaining of insufficient raw material. The speaker admitted that conditions in Netherlands India, which has always supplied a large part of the material for remilling, may be having their effect on the availability of material, but he pointed out that the high cost of labor and an increasing tendency to bypass Singapore had also to be considered as factors in the situation. He thought that a plentiful supply of rice at low cost was most likely to lead to a lower level of wages.

Turning to the open letter on the subject of packing and quality issued by the Rubber Manufacturers Association of America, Inc., and the Rubber Trade Association of New York, Inc., Mr. Salmond stated that while he favored severe penalties in cases of deliberate malpractice, nevertheless he felt that there was now too much technical haggling by dealers and also that buying by the American market was now more selective and discriminating.[1]

On the subject of prices, he gave it as his opinion that a fair price for natural rubber would be an important factor in present world economy and political stability. The United States Government, he felt, seemed to favor a fair price for rubber, but unfortunately the American idea of a fair price was about 1s. per pound, which is 25% over prewar level; while the majority of world commodities are as much as 300% above prewar level.

Total Malayan production of rubber in 1947 was 645,229 tons, Mr. Salmond noted in conclusion, and estimated that world production of natural rubber in 1948 would probably be around 1,400,000 tons.

[1] See p. 521, this issue. EDITOR.

### Open Letter on Packing and Quality

The open letter above referred to has not been too well received here. Indeed the temperate utterances of Mr. Salmond on the subject are in sharp contrast to other publicized remarks which seem more truly to reflect local exasperation with American rubber policy in general and the views of American manufacturers on packing and preparation in particular.

The vice president of the Penang Rubber Traders' Association remarked caustically that American buyers were too anxious to find fault. A rubber planter took the occasion to write an open letter in his turn in which he painted a pretty picture of America's financial policy as one of boosting cotton prices while depressing rubber prices to subsistence level for the producer and "squealing" when rubber prices went above prewar level, while indulging in "political chicanery at Geneva."

### Rioting on Estates

Disquieting news about serious rioting on estates in Johore and Selangor around the end of May is reported in Lockwood's


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*Rubber Report* for June, and press reports dated June 10 indicate that the trouble has spread to other rubber producing areas also and on a scale sufficiently serious to make necessary the declaration of a state of emergency in the districts involved.

The earlier disturbances took place on Chang Peng Swee rubber estate near Segamat, and on a government run estate, both in Johore. Riots on the Segamat estate climaxed a period of unrest here lasting about a month and following the sale of the formerly Chinese-owned estate to new European owners. The new management, it seems, found the predominantly Chinese labor force difficult and gave all one month's notice of dismissal. About a third of the laborers left almost immediately, but the rest decided to stay, threatening to take over the estate. Representatives of the owners and of the union were met with hostility and violence, and a riot squad sent to investigate the disorders was attacked by more than 200 Chinese armed with spears, stones, lead pipes, and bottles. In line with the new policy of the Federation Commissioner of Police, force was met with force; seven laborers were killed, and ten more injured. None of the police was seriously hurt.

At the government-run estate Chinese laborers set fire to the estate factory, causing serious damage. The estate is an "enemy estate," controlled by the Custodian of Enemy Property. About the time of these occurrences, as trouble was anticipated as the result of the proposed eviction of 70 laborers, the two Selangor estates concerned were surrounded by police.

Precise details as to the cause of the disorders occurring about the middle of June are not yet available, but it seems that Chinese Communists committed five murders in rubber areas; the victims included three British planters and two prominent Chinese.

It is doubtful whether these occurrences have really taken residents in Malaya by surprise. For some time it has been clear that not all the lawlessness naturally following the Japanese surrender was completely stamped out. Acts of violence and of intimidation by assorted bandits and robbers, chiefly Chinese, have been taking place right along. To be sure, there have been some deportations of late, but the opinion is pretty general that criminals have all too frequently been treated with less than the necessary severity. It must be admitted that since the liberation, justice pursues a much more deliberate pace and punishment has been almost mild in comparison with that customary under the Japanese, and no doubt this policy has resulted in an unwonted boldness on the part of criminals. Lawlessness is contagious and, especially under the expert stirring up by political agitators, was bound to spread to the ordinary sufficiently law-abiding laborers. The task of the agitators was unfortunately rendered all the easier by the fact that the laborers did have genuine grievances. Large numbers of them came out of the war undernourished, diseased, and homeless. The government and private employers have done much to improve the circumstances of labor, but there is still a lack of decent housing, and more important, the general cost of living is high, especially in Johore, the center of most of the trouble. Wages have been increased, but apparently not soon enough to undo the work of the agitators.

But now that the government has authorized the police to act with greater severity it is hoped that law and order will soon be restored on estates.

However the restoration of discipline on estates will inevitably be accompanied by a drop in production. Lockwood's Malayan correspondent believes, and accordingly estimates production for 1948 and 1949 as below:

| | 1948 Tons | 1949 Tons |
|---|---|---|
| Malaya | 650,000 | 650,000 |
| Indonesia | 350,000 | 300,000 |
| Ceylon | 80,000 | 75,000 |
| Indo-China | 30,000 | 25,000 |
| British Borneo | 60,000 | 50,000 |
| Others | 150,000 | 150,000 |
| Total | 1,320,000 | 1,250,000 |

The estimate of smaller production in 1949 is based on the expectation of the spread of labor troubles to other producing areas. In view of the political unsettlement still current in Netherlands India, 1949 labor troubles there are expected to exceed those of Malaya in 1948.

## Malayan Industry Notes

The cooperative Department is contemplating extension of cooperative marketing schemes for rubber small-holders.

The Rubber Research Institute in Malaya will undertake research on latex to improve its quality before it leaves for manufacturing countries.

The Incorporated Society of Planters is to develop a technical scheme of education for planters with the aim of setting up a professional qualification standard for all planting executives in the Malayan planting industry. In addition the Society is to draw up and negotiate an agreement of minimum service terms and, furthermore, will attempt to secure representation on all bodies appertaining to legislation and cost of living.

## NETHERLANDS INDIA

The news from Netherlands India is favorable. Ever since the Dutch advance in July, 1947, when 70% of Java's present rubber area and 61% of the East Coast of Sumatra rubber plantations were brought under Dutch control, progress has been steady in the rehabilitation of the increasing number of estates being turned over to owners. In the reoccupied districts in Java there are 393 rubber estates, of which 171 had been turned back to owners by the end of 1947, with production resumed on 90. By the end of March, 1948, the number of estates returned to owners had risen to 188, with 115 in production. In Sumatra, 134 rubber estates came under Dutch control; 78 had been taken over by the end of 1947, with production resumed on 46. By the end of last March, 73 estates in East Coast of Sumatra were in production.

In both Java and Sumatra about 50% of the estate factories were found to be practically in running order; while a large proportion of the rest were easily repairable. A few of the factories on Sumatra estates were seriously damaged, but a fairly large number of badly damaged factories were noted on Java estates.

Important factors in the upward swing here are the improving security conditions in the interior of Java and Sumatra and the increasing supplies of food available to labor, with a consequent decrease in their cost of living. It is also to be noted that labor is returning to plantations in increasing numbers.

Exports of crude rubber from Netherlands India in 1947, including shipments from all sources, that is also from the republican territory of Sumatra and rubber smuggled from Dutch-controlled areas, are estimated to have totaled 295,150 tons; of this amount, only 85,323 tons were officially recorded. Very little of the total rubber exported in 1947 was grown on estates.

According to advices received by the United States Department of Commerce, total rubber exports in the first four months of 1948 are estimated at 117,946 tons, including total exports of 45,651 tons from Dutch-controlled areas, and 72,295 tons exported to Malaya from Indonesia.

Estimates for 1948, total 360,000 tons, including 80,000 tons from Sumatra estates, 30,000 tons from Java estates and 250,000 tons from native holdings in Borneo and Southern Sumatra.

## SIAM

Statistics for the first quarter of 1948 revealed unusually large rubber exports from Siam, which shipped 20,320 long tons of rubber to the United States and 2,804 long tons to Malaya, a total for the quarter of 23,124 long tons. This amount compares with total exports of 53,000 tons in the whole of 1947. However it remains to be seen whether Siam will be able to maintain this high level the whole year.

## AUSTRALIA

Vickers, Ltd., has acquired the business of Charles Ruwolt Pty. Ltd., Melbourne. The Ruwolt works, which employed more than 2,000 men, produced machinery for the rubber and engineering industries.

Dunlop Rubber (Australia), Ltd., has received permission to buy a factory at Bairnsdale, from Bairnsdale Food Products, Ltd., now in liquidation.

In association with A. E. Charlesworth, Melbourne, Bintex, Ltd., of Yorkshire, England, has formed Binlatex (Australia), Ltd. The company, which has a capital of £100,000, is to manufacture foam latex cushioning in premises having floor space of 60,000 square feet, purchased in Port Melbourne. A. E. Charlesworth is managing director of the new concern.


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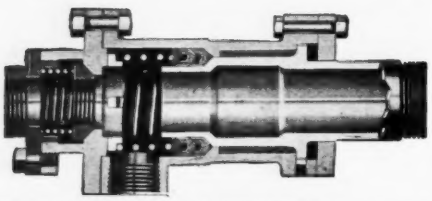

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# INDO-CHINA

All reports concerning Indo-China concur in their representation of a country whose economy is in danger of being completely undermined by the struggle between the French and the Viet-Nam. Rubber is the most important export product here and before the war was grown on about 275,000 acres. Today it is estimated that not more than 102,250 acres are being exploited. Attacks on tappers, supervisors, and European planters, as much as the scorched earth policy of the Viet-Nam resulting in the burning of numerous plantations, are responsible for the sharp decrease in the rubber area now worked and the consequent decline in exports. Not a month goes by without its tale of serious acts of sabotage and murders. Lockwood's *Rubber Report* for June states that 28 out of 300 rubber growers have so far been killed. From a report by the Union des Planteurs de Caoutchouc it is learned that in last March a manager of one of the plantations of the Indo-China Rubber Research Institute, M. Saligne, was assassinated; while a manager of the Soc. des Plantations des Terre-Rouges, one of the most important rubber companies here, was shot by attackers armed with tommy-guns. Besides several attacks have occurred on the villages of workers on the plantations of the Institute.

Despite the many acts of terrorism and sabotage, various plantations and the Rubber Research Institute continue to carry on as best they can, and with the collaboration of the loyal elements among the natives have even succeeded in making some headway.

Outputs in 1947 amounted to about 38,500 tons, and according to Lockwood, provisional figures for the first third of 1948 show an increase over the corresponding period of 1947; the comparative totals are 9,982 tons and 7,312 tons, respectively.

# EUROPE

## FRANCE

### Affairs of Etablissements Bergougnan

At its annual meeting, held in March, Etablissements Bergougnan reported gross proceeds for the period 1946-47, of 333,147,822 francs. Expenses and various charges were 293,587,487 francs, 107,623,970 francs above the total for the preceding business year. Net profits were 39,560,335 francs, and the dividend came to 135 francs per share. The capital was increased from 100 million to 200 million francs.

The company was able to report continued progress and production at a satisfactory rate despite difficulties, such as the failure of replacement equipment ordered from abroad to arrive. A new shop for boots is in production, and construction on a new reclaim shop is progressing. The company has resumed relations with its London house; the Belgian branch is showing satisfactory results; while from Indo-China, the Société des Caoutchoucs de l'Indochine reports that it has so far escaped the most serious difficulties attending the present situation in that territory.

Police action undertaken June 15 to dislodge sitdown strikers at the Bergougnan tire and rubber factory at Clermont-Ferrand, the center of the French rubber industry, touched off a series of sympathetic strikes in which an estimated 50,000 workers were involved and about 200 were injured on both sides in the furious fighting that ensued.

It seems that the trouble started when the unions rejected Bergougnan's offer of an increase of two francs an hour instead of the six francs demanded. About 180 workers seized the plant and announced a sitdown strike. Some hours later special police surrounded the factory and demanded that the strikers surrender, but instead the latter summoned workers from the near-by huge Michelin factory to join them. A fight developed in which strikers hurled bottles of sulfuric acid and tear-gas grenades at the government forces, which replied with tear-gas until reinforcements made it possible to overcome the main resistance.

The following day sympathetic strikes were called all over France by the Communist-led Confederation of Labor. In Clermont-Ferrand business virtually stood still, and all rubber workers had left their jobs; 13,500 sympathy strikers at Michelin seized the plants, but later turned their sympathy strike into a walk-out in support of demands for seniority bonuses.

Reports dated June 18 indicate that labor tension had been considerably eased by the removal of most of the special police sent to oust the sitdown strikers. An official of the Communist-led rubber workers' union reportedly indicated that there was a great possibility that 20,000 union workers in the Michelin and Bergougnan factories would be back at work on June 21.

### Production of Rubber Goods in 1947

During 1947 France manufactured 82,288,968 kilograms of pneumatic tires and tubes and 7,432,572 kilograms of retreads, employing altogether 40,553,489 kilograms of natural rubber and 5,446,129 kilograms of synthetic rubber. Other manufactures in the same year came to 82,465,496 kilograms, requiring 19,469,620 kilograms of natural and 6,951,993 kilograms of synthetic rubber.

Details of the production of tires and the rubber consumed (in kilograms) follows:

| | Weight of Products | Natural Rubber | Synthetic Rubber |
|---|---|---|---|
| Automobile tires | 62,981,928 | 29,805,559 | 2,749,815 |
| Automobile tubes | 6,827,347 | 4,780,432 | 12,590 |
| Airplane tires | 447,137 | 228,122 | 8,134 |
| Airplane tubes | 69,949 | 52,047 | ..... |
| Truck tires | 963,755 | 355,386 | 63,083 |
| Cycle tires | 9,552,320 | 1,439,426 | 1,278,388 |
| Cycle tubes | 1,303,687 | 741,417 | 147,012 |
| Tube tires | 141,845 | 54,896 | 9,163 |

For the retreads, 3,096,504 kilograms of natural rubber and 1,777,944 kilograms of synthetic rubber were used.

The amounts of other rubber goods and the rubber consumed (in kilograms) in their production follow:

| | Weight of Products | Natural Rubber | Synthetic Rubber |
|---|---|---|---|
| Cut sheet | 80,286 | 81,228 | ..... |
| Calendered sheet | 280,177 | 112,876 | 16,872 |
| Solutions and adhesives | 4,643,361 | 308,207 | 9,804 |
| Elastic thread | 333,701 | 360,049 | ..... |
| Rubberized fabric | 9,024,782 | 1,343,085 | 474,577 |
| Hose and tubing | 9,376,222 | 1,903,207 | 728,787 |
| Belting | 6,983,961 | 1,997,134 | 446,810 |
| Flooring and carpets, other than spongy | 460,667 | 90,762 | 15,872 |
| Articles of sponge and cellular rubber | 1,251,683 | 454,356 | 101,089 |
| Footwear | 8,258,581 | 2,260,888 | 418,338 |
| Soles and heels | 18,780,369 | 2,609,903 | 2,065,774 |
| Toys and sporting goods | 1,050,982 | 410,923 | 671 |
| Sanitary and surgical goods | 1,890,780 | 827,298 | 71,990 |
| Anti-corrosion linings | 288,484 | 89,956 | 16,878 |
| Covers for machine rolls | 300,537 | 102,269 | 15,006 |
| Garments, without textiles | 8,429 | 2,215 | 581 |
| Other mechanical goods | 15,236,242 | 3,263,996 | 1,170,074 |
| Small tires | 2,198,962 | 218,169 | 110,421 |
| Hard rubber | 2,017,290 | 437,344 | 219,471 |
| Electric cables | ..... | 2,595,755 | 1,068,978 |

## GERMANY

The second meeting of the Rubber Committee of the Chemical Division of the Chamber of Technical Sciences, in the Soviet Zone of Germany, held on March 9, was attended by 80 persons

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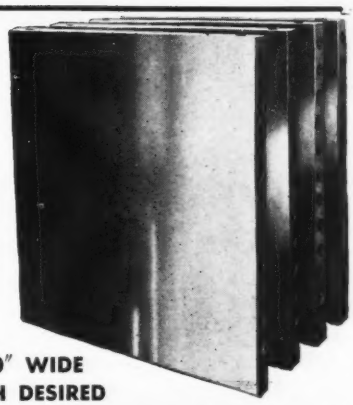

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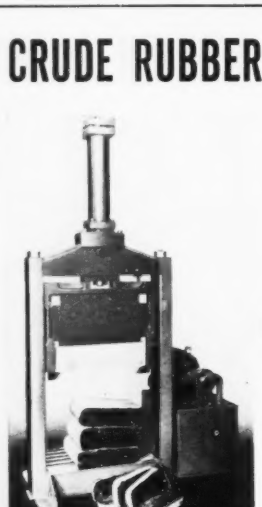

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including representatives of the administration, science, and industry. After the chairman, Prof. Franck, president of the Chemical Division, had outlined the main task of the committee as one of supporting and furthering the planning of the Rubber Section of the Central Administration of Industry, with expert aid, Director Berthold, of C. Muller, Berlin-Weissensee, was elected president of the committee.

Next the following working committees were formed: Machinery; Raw Materials and Auxiliary Materials and Compounding Practice; Tires; Surgical and Dipped Rubber Goods; Mechanical Goods; Soles and Heels; Rubber Footwear; Proofed Fabrics; Rubber Solutions and Cements; Hard Rubber Goods; Testing and Research; Head Committee (Coordination of the Working Committees).

The personnel of the committees included a number of rubber firms well known in prewar days, including Deka, of Ketschendorf (tires); Elbe, Klein-Wittenberg (tires); Fromms Act, Friedrichshafen (surgicals); Fluegel & Polter, Leipzig (proofed fabrics); Weiss & Baessler, Leipzig (surgical soft and hard rubber goods); C. Muller, Berlin-Weissensee (surgical and mechanicals); Degufrah, Berlin-Weissensee (tires); Gummiwerk Erfurt, Erfurt (surgical goods); Zieger & Wiegand, Leipzig (surgical goods); Dietsch & Ilgen, Zeulenroda (surgical goods); C. A. Adloff, Tabarz (mechanicals); Blodner & Vierschrodt, Gotha (mechanicals); Thuringer Schlauchweberei, Waltershausen, (mechanicals); G. & A. Thoenes, Radebeul (mechanicals); Grahneis & Borner, Zipsendorf, (heels and soles); Friedrich Wilop, (footwear); August Kibele, (hard rubber); Deutsche Kabelwerke, Berlin (proofed goods); Mariendorfer Gummiwarenfabrik, Berlin-Mariendorf (proofed goods); and Veritas, Berlin-Lichterfelde (proofed goods).

# EUROPEAN NOTES

Before the war Denmark normally required 1,500,000 cycle tires a year. During hostilities a severe shortage of these tires developed with consequent heavy postwar demand, which it seems is being met by local production. In 1947 the country manufactured 2,400,000 cycle tires.

The Swedish Plastics Federation (Svenska Konsthartsföreningen) has moved from Västra Trädgardsgatan 19 A to Karlavägan 43 II, Stockholm, Sweden. Cable address and telephone numbers remain the same. Jan-Erik Janson is executive secretary of the organization.

According to the terms of a commercial and financial agreement between Argentina and the Netherlands, signed on March 18, 1948, at Buenos Aires, the Netherlands is to do everything in its power to provide Argentina with 3,000 tons of rubber from Netherlands India every year for five years.

The Vredestein-Goodrich tire works at Enschede is said to be rapidly reaching the stage where it will be in full working order. Meanwhile it is reported that daily output is now 300 tires and 300 tubes, and that it is hoped to be able to increase this shortly to 500 tires and tubes. It is also stated that plant extensions are under consideration which would permit daily production of 3,000 to 4,000 tires.

## Strain Tester for Rubber

*(Continued from page 517)*

### Summary and Conclusions

A tester for measuring the strain of rubber vulcanizates, when subjected to a predetermined stress, is described. The operation of the tester and a description of the apparatus for cutting and measuring the test specimens are presented. With this equipment routine determinations of a point on the stress-strain curve can be made with greater accuracy and precision than has hitherto been possible with the usual stress-strain equipment. This strain test also requires less labor than the customary stress tests.

# Editor's Book Table

## BOOK REVIEWS

**"Practical Latex Work."** H. J. Stern. Foreword by R. J. Noble. The Blackfriars Press, Ltd., Leicester, England. Second Edition, 1947. Boards, 4⅞ by 7¼ inches. 107 pages. Price 8/6d.

The first edition of Dr. Stern's very useful little book, published in 1940, filled a need of a source of information on latex and latex processing for the plant chemist and engineer that proved to be very valuable to those in the field or about to enter it. The demand for the book continued long after the available copies were exhausted. This second English edition includes most of the material of the first edition in a revised and improved form and new material on rubber thread and sponge and on synthetic latices.

The various types of natural latices are discussed in the first chapter, as before, together with vulcanized latex and artificial dispersions. The details of equipment, compounding ingredients and the processing of the latex, the necessary pastes and emulsions, etc., are treated in the second chapter.

The third chapter is devoted to the actual manufacture of dipped goods from latex, and the fourth chapter to the application of latex to textiles, fibers, and paper. Some mention is made of the "Positex" process for textile impregnation in this latter chapter.

The fifth chapter includes some discussions of processes involving extrusion and latex sponge, and the sixth chapter offers some information on neoprene, GR-S, and "Thiokol" latices, but this latter does not cover advances since early 1947.

The book is concluded with a short section on calculating the cost of latex compounds.

**"A Toddler's Guide to the Rubber Industry."** D. Lowe. Distributed by E. E. Halsted, 84 Longley Rd., London, S.W.17, England. Board, 7½ by 5 inches, 67 pages. Price, 8s./6d.

This book is composed of a series of articles which originally appeared in *The India-Rubber Journal* from November, 1946, to February, 1947, and bore the explanatory sub-title, "Alice in Rubberland." A satire on the workings of a rubber company, the book deals with the visits of Alice to the "Highly Successful Rubber Co." Although consistently amusing, the book manages to point a moral on inter-company rivalries and management policies. Among the satirical portraits of company executives presented in individual chapters are those on the chief inspector whose primary function is to serve as the sacrificial lamb; the purchasing agent who starts each day with the firm conviction that everything a seller offers is too expensive and inferior in quality; the chief chemist who keeps his knowledge to himself; the sales manager who does his work on the golf course; the chief engineer and works manager who constantly quarrel over machinery operation capacities; the cost accountant whose statistical analyses reflect his health and state of mind; the department foreman who must be broad shouldered because of all the blame heaped upon him; the company secretary who stands between the company and the law and is disliked by both factions; and the managing director who suffers from a severe case of "Iamit."

**"Adventures in Man's First Plastic.** The Romance of Natural Waxes." Nelson S. Knaggs. Foreword by Walter J. Murphy. Reinhold Publishing Co., 330 W. 42nd St, New York 18, N. Y. Cloth, 9 by 6 inches, 344 pages. Price, $6.75.

Written in the style of a romantic adventure, this book consists of chapters or stories on the history and the production of the different natural waxes. Some of the stories involve the author's personal experience, such as those describing his expedition in the Amazon area for Cauassú wax and his trip in Texas searching for candelilla wax. The author combines technical knowledge of his subject with an ability to write entertainingly. Added interest is derived from the many photographs taken by the author and by his side-excursions into other fields, such as exploration, botany, entomology, archaeology, and chemistry. Examples of these side-lights include a description of the growth and native tapping of *Hevea* trees in the Amazon; the chapter on wax through the ages which describes its use in religion, art, Egyptian mummy making, and other fields; the story of beeswax which contains a fascinating description of the life and activities of the honey bee; and the chapter on spermaceti wax which gives much interesting information on whaling.


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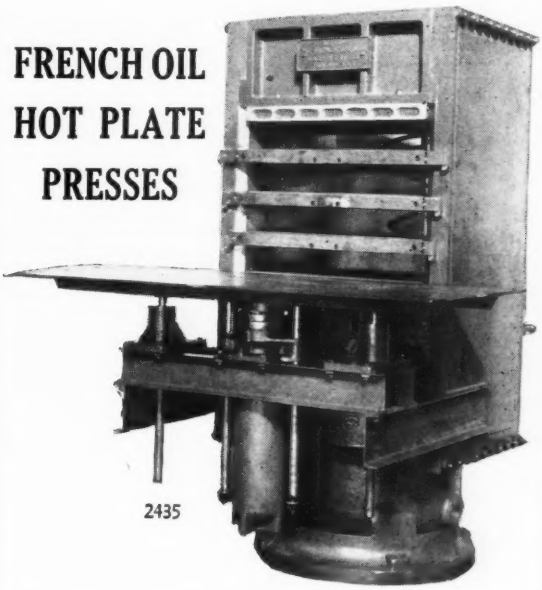


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**"The Chemistry of Organic Cyanogen Compounds."** Vartkes Migrdichian. American Chemical Society Monograph Series, No. 105. Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Cloth, 9 by 6 inches, 460 pages. Price, $12.

This important contribution to the literature of organic chemistry presents a great deal of factual information on cyanogen compounds, with emphasis on their chemistry and some information on methods of preparation. The vast field of organic cyanogen chemistry has necessitated a certain amount of condensation and consequent loss in critical evaluation of data. In addition, major emphasis is placed on the older literature, and recent work in the field, which in some cases has drastically revised previous theories, has been largely ignored. As for nomenclature, the author has followed that given in his literature references with resultant inconsistency and confusion. The text is organized into 18 chapters, and there are comprehensive author and subject indices. Despite its obvious shortcomings, the book should prove of great value to organic chemists, particularly those concerned with nitrogen and its reactions.

## NEW PUBLICATIONS

**"Annual Report on the Progress of Rubber Technology.** Vol. X, 1946." Published by W. Heffer & Sons, Ltd., Cambridge, England, for the Institution of the Rubber Industry, 12 Whitehall St., London, S.W.1, England. Paper, 9½ by 7¼ inches, 132 pages. Price, 4/6 to members; 12/6 to non-members. This edition of the annual report contains the following articles: "Historical and Statistical Review," T. R. Dawson and C. J. Redfern; "Planting and Production of Raw Rubber, Latex, Gutta Percha, Balata, Chicle and Jelutong," Mr. Dawson; "Properties, Applications, and Utilization of Latex," C. F. Flint; "Chemistry and Physics of Raw Rubber and Rubber Derivatives, Gutta Percha, Balata, Chicle, and Jelutong," B. J. Habgood; "Synthetic Rubber," W. J. S. Naunton; "Testing Equipment and Specifications Other Than for Latex," R. G. Newton; "Compounding Ingredients, Accelerators, Antioxidants, and Softeners, Etc.," J. H. Carrington; "Fibers and Fabrics," Fletcher Chadwick; "Chemical and Physical Properties of Vulcanized Rubber," L. Mullins; "Tires," L. R. Mernagh; "Belting," N. G. Hiscox; "Hose and Tubing," F. H. Puxty; "Cables and Electrical Insulation," W. C. Barry; "Footwear," R. C. Davies; "Mechanical Rubber Goods," R. W. Parris; "Games, Sports Accessories, Toys, Etc.," J. G. Anderson; "Rubber Flooring," W. H. Reece; "Surgical Goods," C. R. Pinnell; "Textile-Rubber Composites, Solvents, and Cements," W. N. Lister; "Cellular Rubber," A. Cooper; "Hard Rubber," R. J. Tudor; "Works Processes and Materials, Including the Treatment of Raw Rubber in the Factory and the Treatment of Vulcanized Rubber," E. V. Bratby; and "Machinery and Appliances," H. Willshaw.

**"Latex Foam."** Rubber Development Bureau, 1631 K St., N.W., Washington 6, D. C. 12 pages. This "fact" booklet on latex foam presents information on the product's composition, methods of production, uses, advantages, supply, and sources.

**"Indonex Plasticizers in Natural Rubber of Various Qualities."** Circular No. 13-22, June 2, 1948. Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill. 4 pages. Formulations and test data show the good results obtainable in two typical grades of mechanical goods compounds using Indonex with a high loading of SRF black and various grades of natural rubber from smoked sheets down to flat bark crepe.

**"Laurex in Natural Rubber."** Compounding Research Report No. 9. Naugatuck Chemical Division, United States Rubber Co., Rockefeller Center, New York 20, N. Y. 8 pages. Data show Laurex to be an excellent plasticizer for natural rubber and to be a stronger activator of thiazoles in natural rubber than stearic acid. The product is also shown to develop optimum physical properties in off-grade natural rubber stocks.

**"Vinylite Resins and Plastics**—Forms, Properties, Applications." Bakelite Corp., 300 Madison Ave., New York 17, N. Y. 38 pages. This booklet discusses the different types of Vinylite resins, describes and illustrates their applications, and gives tables of properties of the various Vinylite sheets, film, molding and extrusion compounds, Plastisols, and resin adhesives.

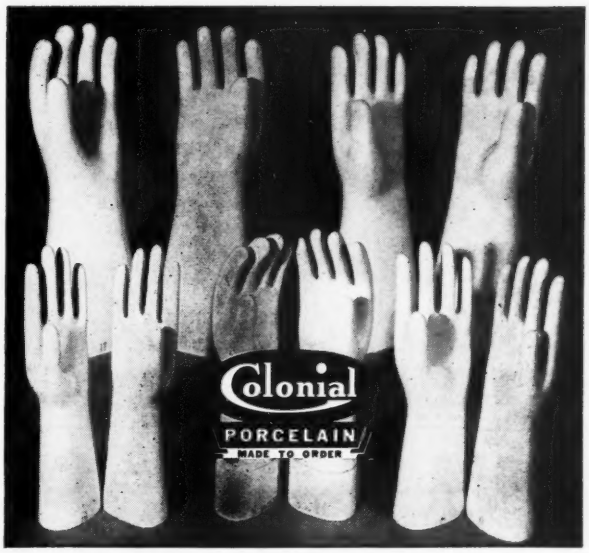
Publications of the British Rubber Producers' Research Association, 48 Tewin Rd., Welwyn Garden City, Hertfordshire, England. No. 86. **"Some Thermodynamic Properties of High Polymers, and Their Molecular Interpretation."** Geoffrey Gee. 34 pages. This booklet reviews some thermodynamical properties of high polymers with emphasis on recent work relating these properties to molecular structure. Although general in treatment, most examples refer to natural rubber. Subjects include equilibrium in polymer systems, crystallization, second-order transitions and brittle temperatures, high elasticity, absorption of gases and vapors by polymers, and solubility and swelling of polymers in liquids. No. 87. **"Kinetic Studies in the Chemistry of Rubber and Related Materials. Part IV.** The Inhibitory Effect of Hydroquinone on the Thermal Oxidation of Ethyl Linoleate." J. L. Bolland and P. Ten Have. 10 pages. The mechanisms of antioxidant protection in rubber cannot at present be determined, but this mechanism can be identified in simple oxidation systems such as the autoxidation of ethyl linoleate with hydroquinone antioxidant. It is shown that one molecule of hydroquinone is converted to an inhibiting product for every two interactions between hydroquinone and peroxide radicals.

No. 88. **"Statistical Treatment of Polymer Solutions at Infinite Dilution."** W. J. C. Orr. 16 pages. Current statistical theories of polymer solutions are least satisfactory for dilute solutions. This paper is the first attempt to estimate the number of points at which a flexible molecule curls back into contact with itself and to discuss how this action depends on the heat of mixing. Results obtained are in rough agreement with experimental work on solutions of rubber in benzene. No. 89. **"The Photo-Elastic Properties of Rubber. Part. I.** The Theory of the Optical Properties of Strained Rubber. **Part II.** Double Refraction and Crystallization in Stretched Vulcanized Rubber." L. R. G. Treloar. 22 pages. The study of double refraction provides a rapid and simple alternative method for estimating development of crystallization in stretched rubber. The theoretical laws of photo-elasticity are worked out for a homogeneous strain of the most general kind. No. 90. **"Syntheses in the Thiopyran Series. Part I.** Tetrahydro-Derivatives." Ralph F. Naylor. 6 pages. The reaction of sulfur or hydrogen sulfide with geraniolene and dihydromyrcene produces considerable proportions of cyclic sulfides of the thiopyran series. In an effort to establish the structure of these compounds, 2,2,6,6-tetramethyl-tetrahydrothiopyran and 2,2,6-trimethyl-6-ethyltetrahydrothiopyran are synthesized and, in a subsequent paper, shown to be the same as the reaction products of hydrogen sulfide with geraniolene and dihydromyrcene, respectively. No. 91. **"Tensile Strengths of Pure Gum Natural Rubber Compounds."** Geoffrey Gee. 12 pages. The tensile properties of a range of pure gum stocks are reviewed and shown to depend on the amount of crystallization at break. The most important single factor in determining tensile strength is the degree of cross-linking. Vulcanization produces reactions which inhibit crystallization and thus reduce tensile strength, especially when the degree of cross-linking is large. These ideas explain the effects of swelling and tensile test temperature, and are used to discuss overcure, reversion, and aging. No. 92. **"Large Elastic Deformations of Isotropic Materials. Part I.** Fundamental Concepts. **Part II.** Some Uniqueness Theorems for Pure, Homogeneous Deformation." R. S. Rivlin. 50 pages. The general equations for relations between the stresses and strains in an inhomogeneously strained body are developed in Part I, and the problem of a body acted on by a simple set of stresses is examined in detail in Part II. These papers are the first of a series on the development of a fundamentally new approach to the mathematical theory of elasticity.

**"Commonwealth Engineering Co.** Report on Operations, 1947." Commonwealth Engineering Co., Dayton, O. 16 pages. This report describes the development and present status of the company and lists research projects under way, including work on vinyl films, a molding machine for thermosetting materials, cellular rubber, injecting molding of rubber, molding oven, heat sealing industrial tapes, and many others.

**"G. B. Light Process Oil."** G. B. Report No. 1, March, 1948. Golden Bear Oil Co., P.O. Box 846, Oildale, Calif. 11 pages. This report gives information on the production, specifications, properties, mixing, and compounding of the oil, and laboratory test data on its use in various natural, neoprene, GR-S, and blended rubber compounds.

**"Hercules Products."** Hercules Powder Co., Wilmington, Del. 20 pages. Brief descriptions are given of the composition, uses, and potential applications of the company's products, classified by chemical family groups. These groups include cellulose, synthetic resins, terpene solvents and chemicals, chlorinated products, dairy products, and explosives and sporting powders.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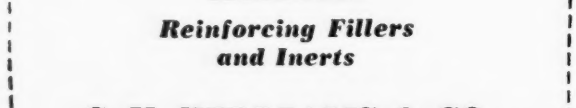

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**"Tervan 2800."** Esso Technigram, May 12, 1948. Esso Standard Oil Co., 15 W. 51st St., New York 19, N. Y. 8 pages. Tervan 2800 is a blend of refined paraffin wax and Vistanex. This report gives information on the development, properties, and applications of the material, including use as an aid for anti-sun materials in rubber compounding and use in sealing and coating compounds of various types.

**"Rubber Antioxidant PDA-10."** Research Report No. 1. Benson Process Engineering Co., Eden, N. Y. 4 pages. Extensive laboratory test data compare PDA-10 with commercial antioxidants in typical natural rubber tread and white stock recipes. PDA-10, an antioxidant selling for 37-42¢ a pound, is shown to be comparable to BLE, BLE Powder, AgeRite Hipar, Permalux, and phenyl-beta-naphthylamine.

**"How to Select the Right Oven for Your Process."** Gehnrich & Gehnrich, Inc., Woodside, L. I., N. Y. 32 pages. **"Design Increases Sales."** Barnes & Reinecke, Inc., Chicago, Ill. 4 pages. **"Permanent Magnet Sub-Assemblies."** General Electric, Pittsfield, Mass. 4 pages. **"Bi-Monthly Supplement to All Lists of Inspected Appliances, Equipment, Materials."** April, 1948. Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill. 83 pages. Publications of American Standards Association, 70 E. 45th St., New York 17, N. Y. **"Standards and Top Management."** 12 pages. **"Democracy in Action."** 19 pages. **"Yale Hand Lift and Worksaver Pallet Trucks."** Yale & Town Mfg. Co., Philadelphia, Pa. 20 pages. **"Approved Equipment for Industrial Fire Protection.** 1948 Supplement." Associated Factory Mutual Fire Insurance Cos., 184 High St., Boston 10, Mass. 8 pages.

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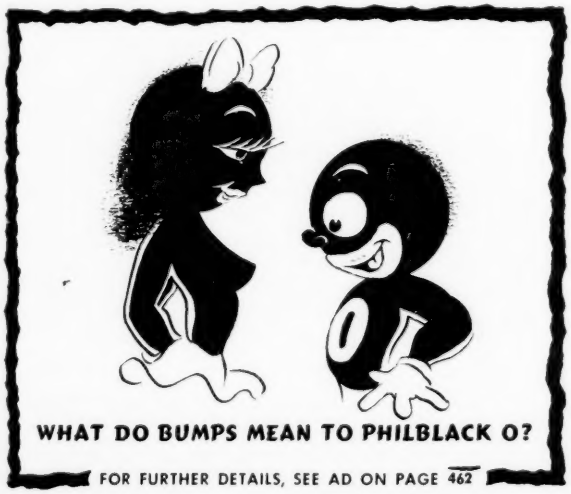

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# Market Reviews

## CRUDE RUBBER

### Commodity Exchange

WEEK-END CLOSING PRICES

| | April 30 | May 29 | June 5 | June 12 | June 19 | June 26 |
|---|---|---|---|---|---|---|
| June | 21.80 | 22.30 | 22.00 | 22.35 | 22.50 | 22.15 |
| July | 21.20 | 21.85 | 21.55 | 21.90 | 22.10 | 21.68 |
| Aug | 20.80 | 21.75 | 21.52 | 21.95 | 22.20 | 21.78 |
| Sept | 20.70 | 21.65 | 21.50 | 21.99 | 22.30 | 21.85 |
| Oct | 20.60 | 21.60 | 21.45 | 21.92 | 22.27 | 21.85 |
| Nov. | 20.55 | 21.55 | 21.40 | 21.86 | 22.27 | 21.85 |
| Dec. | 20.50 | 21.45 | 21.35 | 21.80 | 22.25 | 21.88 |
| 1949 | | | | | | |
| Jan. | 20.50 | 21.40 | 21.30 | 21.65 | 22.09 | 21.73 |
| Feb. | 20.50 | 21.35 | 21.20 | 21.55 | 21.92 | 21.60 |
| Mar. | 20.50 | 21.30 | 21.10 | 21.45 | 21.75 | 21.47 |
| April | 20.50 | 21.25 | 21.00 | 21.30 | 21.55 | 21.32 |
| May | 20.50 | 21.25 | 20.90 | 21.10 | 21.40 | 21.15 |
| June | 20.50 | 21.20 | 20.85 | 21.05 | 21.35 | 21.10 |
| July | 20.50 | 21.20 | 20.80 | 21.00 | 21.30 | 21.05 |
| Aug | | 21.20 | 20.75 | 20.95 | 21.25 | 21.00 |

RUBBER futures moved irregularly through a relatively narrow price range during June on the New York Commodity Exchange. Trading was quite light, and only a moderate buying interest was displayed by domestic consumers. Reflecting the thinness of the market was the total sales volume for June of 18,980 tons, which may be compared with the low May total of 19,170 tons.

Despite the light trading the market was firm and reflected the persistent strength of the primary markets, both domestic and foreign. This strength was based on active buying by European countries, expectation of heavier United States stockpile buying in the near future, and the growing threat to production and shipments of rubber from Malaya posed by increasing labor unrest in that country. Counterbalancing this upward trend was the cautious buying policies being pursued by United States manufacturers in their domestic purchases and by the government in the stockpiling program.

One prominent aspect of the futures trading was the maintenance of a program for September and December deliveries over the July delivery. This premium, approaching the customary price structure of the prewar market, was said to reflect the lack of pressure on spot supplies and the spread of factory buying interest into distant deliveries in the physical market.

July futures opened the month at 22.07¢, fluctuated irregularly in the 21.55-22.25¢ range for most of the month, and closed at 21.95¢ on June 30 after June futures were taken off the boards. September futures, which began at 21.87¢ on June 1, fluctuated between 21.45¢ and 21.95¢ until June 9. The premium for September deliveries took effect on June 10, and September prices moved between 21.92¢ and 22.4.¢ during the balance of the month, closing at 22.12¢ on June 30.

### New York Outside Market

WEEK-END CLOSING PRICES

| | April 30 | May 29 | June 5 | June 12 | June 19 | June 26 |
|---|---|---|---|---|---|---|
| No. 1 R.S.S.: | | | | | | |
| June | 22.25 | 22.63 | 22.50 | 22.63 | 22.88 | 22.75 |
| July-Sept. | 21.63 | 22.25 | 22.25 | 22.50 | 22.75 | 22.50 |
| Oct.-Dec. | .... | .... | 22.00 | 22.25 | 22.63 | 22.38 |
| No. 3 R.S.S. | 20.50 | 21.00 | 21.00 | 21.13 | 21.13 | 21.00 |
| No. 2 Brown | 17.00 | 18.00 | 17.75 | 18.25 | 18.00 | 18.00 |
| Flat Bark | 12.50 | 12.50 | 12.75 | 12.50 | 12.25 | 12.00 |

THE New York Outside Market for rubber continued to be quiet during June. Factory buying interest varied from dull to moderate, with purchases being made in limited lots. In general the larger consumers remained out of the market except for some spotty interest in off-grades for third- and fourth-quarter delivery. Most of the buying was done by the smaller companies, and demand centered in the third quarter. There were some reports of government stockpile buying concentrated in October-December deliveries. Despite slow demand and considerable resistance to price advances, market undertones were firm, and the strength of the market reflected the good positions of the London and the Singapore physical markets.

The spot price for No. 1 ribbed smoked sheets was 22.88¢ on June 1, fluctuated between 22.50¢ and 23.13¢ during most of the month, and closed at 22.75¢. A good deal of the buying interest continued to reach out to distant deliveries, and this policy was reflected in the prices for July-September, which fluctuated between 22.25¢ and 23.00¢ during most of the month, and for October-December deliveries, which varied between 22.13¢ and 22.88¢. As for the lower quality grades for spot delivery, the No. 3 smoked sheets fluctuated between 21.00¢ and 21.50¢; No. 2 Brown varied within the 17.75-18.50¢ range; and Flat Bark prices moved irregularly between 12.50¢ and 13.00¢.

### Latices

DOMESTIC use of *Hevea* latex has just about reached its prewar volume after many months of very much lower absorption, according to Arthur Nolan, Latex Distributors, Inc., writing in Lockwood's June *Rubber Report*. *Hevea* latex is now being used at the rate of 24,000 tons annually. Foam has already contributed greatly to increased domestic consumption of latex and will doubtless continue to expand in use.

Immediate large increases in *Hevea* latex consumption can only result from its replacing GR-S latex in tire, paper, and textile application, Mr. Nolan writes. Long-range and more gradual increases in the use of *Hevea* latex will result first from foam expansion, second from increases in the general line of latex-containing products, and third from new products created by research and development. On the other hand *Hevea* latex is very vulnerable to GR-S latex competition, particularly in view of the latter material's present price advantage. Although *Hevea* latex prices dropped from 27.75-30.375¢ a pound, dry weight, in May to 27.75-28.25¢ a pound early in June, they are still appreciably higher than the 18.50-20.25¢ a pound price of GR-S latex.

While No. 1 ribbed smoked sheets remain at approximately 22.50¢ a pound, another reduction in latex prices is not likely unless there is "distress" latex selling. Such selling would be only temporary and would lower prices for a short time. The current latex differential of 5-6¢ over smoked sheets is comparable to prewar differentials, despite increased plantation labor and operating costs. A substantial decline in smoked sheet prices would probably lower the *Hevea* latex price and prompt additional usage in tires.

Mr. Nolan gives April receipts of *Hevea* latex as 2,283 long tons, dry weight, the lowest figure of the past four months. April consumption of 2,051 long tons was only slightly under the record total of 2,185 long tons in March. *Hevea* latex stocks at the end of April totaled 8,314 long tons. Production of GR-S latex during April was 1,900 long tons, dry weight, and an estimated 1,842 long tons were produced during May.

### Fixed Government Prices*

| | |
|---|---|
| **Guayule** | |
| Guayule *(carload lots)* | $0.17½ |
| **Latex†** | |
| *Hevea*, normal *(tank car lots)* | .30¾ |
| Centrifuged *(tank car lots)* | .32½ |
| GR-S, Type 2 *(tank car lots)* | .18½‡ |
| *(Carload, drums)* | .268 |
| *(Less carload, drums)* | .273 |
| Types 3 and 4 *(tank car lots)* | .18½‡ |
| *(Carload, drums)* | .26 |
| *(Less carload, drums)* | .26½ |
| Type 5 *(tank car lots)* | .20¾‡ |
| *(Carload, drums)* | .27¾ |
| *(Less carload, drums)* | .27¾ |
| **Plantation Grades** | |
| No. 1X Ribbed Smoked Sheets | .23 |
| 1X Thick Pale Latex Crepe | .29 |
| 1 Thick Pale Latex Crepe | .29 |
| 2 Thick Pale Latex Crepe | .28½ |
| 3 Thick Pale Latex Crepe | 28¾ |
| 1X Thin Pale Latex Crepe | .29 |
| 1 Thin Pale Latex Crepe | .29 |
| 2 Thin Pale Latex Crepe | .28½ |
| 3 Thin Pale Latex Crepe | .28¼ |
| Liberian A | .28⅝ |
| AA | .29 |
| RCMA Watermarked Crepe No. 16 | .37⅞ |
| 17 | .32⅜ |
| 18 | .30⅞ |
| Sole Crepe Trimmings | .28½ |
| No. 1X Thin Pale Latex Crepe Trimmings | .28½ |
| 1X Brown Crepe | .21⅞ |
| 2X Brown Crepe | .21⅜ |
| 2 Remilled Blankets (Amber) | .21¾ |
| 3 Remilled Blankets (Amber) | .21⅜ |
| Rolled Brown | .185 |
| **Synthetic Rubber** | |
| GR-M (Neoprene GN) | .32 |
| GR-M-10 (Neoprene GN-A) | .32 |
| GR-S (Buna S) | .18½ |
| GR-I (Butyl) | .18½ |
| **Wild Rubber** | |
| Upriver Coarse (crude) | .12⅝ |
| (Washed and dried) | .20¼ |
| Islands Fine (crude) | .14⅝ |
| (Washed and dried) | .22½ |
| Caucho Ball (crude) | .11⅝ |
| (Washed and dried) | .19½ |
| Mangabiera (crude) | .08¼ |
| (Washed and dried) | .18 |

* For a complete list of all grades of dry rubbers see Rubber Reserve Co. General Sales and Distribution Circular, July 1, 1945, as amended.
† Prices per pound total solids.
‡ Plus average freight charge of 0.75¢ per pound dry weight.

## RECLAIMED RUBBER

THE reclaimed rubber market during June showed very little change from conditions during the previous month. A slight increase in demand from domestic consumers was noted as a result of increased tire production. On the other hand, exports of reclaim were encountering the usual difficulties of export licenses and foreign dollar shortages. Production of reclaim continued at a high level.

Final March and preliminary April statistics on the reclaimed rubber industry are now available. Production of reclaim during March totaled 24,089 long tons; consumption, 24,362 long tons; exports,

The term

**"COTTON FLOCKS"**

does not mean cotton fiber alone

**EXPERIENCE**

over twenty years catering to rubber manufacturers

**CAPACITY**

for large production and quick delivery

**CONFIDENCE**

of the entire rubber industry

**KNOWLEDGE**

of the industry's needs

**QUALITY**

acknowledged superior by all users are important and valuable considerations to the consumer.

*Write to the country's leading makers for samples and prices.*

**CLAREMONT WASTE MFG. CO.**

**CLAREMONT N. H.**

***The Country's Leading Makers***

**LITTLEJOHN & CO., Inc.**

**120 WALL STREET**

**NEW YORK 5, N. Y.**

CRUDE & SYNTHETIC RUBBER

NATURAL & SYNTHETIC LATEX

**Balata, Gutta Percha**
**Pontianak—Gutta Siak**
**All Grades of**
**Brazilian & Far Eastern**
**Chewing Gum Raw Materials**

**BROCKTON TOOL COMPANY**

Central Street — QUALITY MOULDS FOR ALL PURPOSES — South Easton, Mass.

THE FIRST STEP—A QUALITY MOULD

**LONG ON *SERVICE* . . . AND *SAFETY* . . . DEPENDABLE FLEXO JOINTS**

TYPE "A"

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Through year after year of safe, trouble-free service, Flexo Joints have proven their superiority in the Rubber Industry — wherever steam, compressed air, water or other fluids are conveyed to moving feed lines.

Supplied in four styles for pipe sizes from ¼" to 3".

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TYPE "F"

**QUALITY** **INTEGRITY** **SERVICE**

67 YEARS WITHOUT REORGANIZATION

**BELTING**

Transmission—Conveyor—Elevator

**HOSE**

for every purpose
Water—Fire—Air—Steam

**PACKING**

Sheet & Rod Packings
for every condition

*Mechanical Specialties of Every Description*

**HOME RUBBER COMPANY**

*Factory & Main Office*
TRENTON 5, N. J.

**LONDON: 107 Clifton St., Finsbury** **CHICAGO: 168 North Clinton St.** **NEW YORK: 80-82 Reade St.**

937 long tons; and month-end stocks, 38,313 long tons. Preliminary figures for April show a production of 21,042 long tons; consumption, 22,023 long tons; exports, 1,049 long tons; and end-of-month stocks, 37,002 long tons.

There were no changes in reclaimed rubber prices during June.

**Reclaimed Rubber Prices**

| | Sp. Gr. | ¢ per Lb. |
|---|---|---|
| Whole tire | 1.18-1.20 | 8 / 8.5 |
| Peel | 1.18-1.20 | 9 / 9.5 |
| Inner tube | | |
| Black | 1.20-1.22 | 12.75/13.25 |
| Red | 1.20-1.22 | 13.5 /14 |
| GR-S | 1.18-1.20 | 9.5 /10 |
| Butyl | 1.16-1.18 | 8.5 / 9 |
| Shoe | 1.50-1.52 | 8.25/ 8.75 |

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

## SCRAP RUBBER

THE restricted activity of the scrap rubber market during the past few months finally resulted in some price decreases for tires and tubes. Mixed auto tires dropped from $13.00 per net ton to $12.00 in the East and $12.50 at Akron. Mixed auto tubes fell from 4.25¢ to 4.00¢ per pound both in the East and at Akron; while red passenger tubes dropped from 7.25¢ per pound to 6.75¢ in the East and 7.00¢ at Akron.

Trading was very limited, with most consumers refusing to stock up on scrap rubber. Should this condition continue, lower prices for peelings and other scrap items can be expected. At the same time foreign demand was reported to be quite good, although European buyers were being hampered by import license restrictions and lack of currency.

The Joint Import-Export Agency in Germany was expected to come into the market for scrap rubber some time early in July. The Agency's policy is said to call for buying periods in January and July, although the amount of scrap rubber needed is not known. It was reported that the Japanese Board of Trade may soon be in the market for scrap rubber.

Following are dealers' buying prices for scrap rubber, in carload lots, delivered to mills at points indicated:

| | Eastern Points | Akron, O. |
|---|---|---|
| | (Per Net Ton) | |
| Mixed auto tires | $12.00 | $12.50 |
| S.A.G. passenger (natural) | nom. | nom. |
| Truck (natural) | nom. | nom. |
| Peelings (natural), No. 1 | 50.00 | 50.00 |
| No. 2 | 31.00 | 31.00 |
| No. 3 | 29.00 | 29.00 |
| | (¢ per Lb.) | |
| Mixed auto tubes | 4.00 | 4.00 |
| Red passenger tubes | 6.75 | 7.00 |
| Black passenger tubes | 5.00 | 5.00 |
| Truck tubes | 4.75 | 4.75 |
| Mixed puncture-proof tubes | 0.50 | 0.50 |
| Air brake hose | nom. | nom. |

## RAYON

TOTAL shipments of rayon to domestic consumers during May amounted to 93,600,000 pounds, an increase of 2,800,000 pounds over the April figure. For the first five months this year rayon deliveries have totaled 447,600,000 pounds, 17% above the corresponding 1947 period.

May rayon filament yarn deliveries totaled 69,900,000 pounds, of which 46,100,000 pounds were viscose and cupra and 23,800,000 pounds were acetate. Rayon staple and tow shipments during May amounted to 23,700,000 pounds, consisting of 16,200,000 pounds viscose and 7,500,000 pounds acetate. Rayon stocks held by producers at the end of May totaled 12,400,000 pounds. Of this total, 6,300,000 pounds were viscose and cupra yarn, 2,400,000 pounds were acetate yarn, and 3,700,000 pounds were staple.

Current prices for high-tenacity rayon tire yarns and fabrics are listed in the table below:

**Rayon Prices**

| | | |
|---|---|---|
| Tire Yarns: | | |
| 1100/480 | $0.53 | / $0.55 |
| 1100/490 | .55 | |
| 1150/490 | .55 | |
| 1650/720 | .52 | / .54 |
| 1650/980 | .54 | |
| 1900/980 | .54 | |
| 2200/960 | .53 | |
| 2200/980 | .53 | |
| Tire Fabrics: | | |
| 1100/490/2 | .69 | |
| 1650/980/2 | .665 | / .68 |
| 2200/980/2 | .65 | |

## COTTON AND FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

| Futures | April 24 | May 29 | June 5 | June 12 | June 19 | June 26 |
|---|---|---|---|---|---|---|
| Aug. | 36.03 | 35.98 | 35.51 | 35.29 | 35.30 | 34.73 |
| Oct. | 33.43 | 33.66 | 33.28 | 33.03 | 33.19 | 32.88 |
| Dec. | 32.58 | 33.02 | 32.76 | 32.46 | 32.59 | 32.58 |
| 1949 | | | | | | |
| Mar. | 32.25 | 32.73 | 32.56 | 32.28 | 32.37 | 32.38 |
| May | 31.91 | 32.42 | 32.25 | 32.00 | 32.15 | 32.21 |
| July | 31.05 | 31.70 | 31.60 | 31.33 | 31.72 | 31.90 |

A NARROW trading range characterized cotton prices on the New York Cotton Exchange during June. A strictly professional trading market prevailed, almost completely controlled by technical factors. This situation is expected to last until the new crop staples appear, when the problem of acquiring spot cotton may cause a temporary increase in prices, especially if ECA should start buying. This last occurrence is not believed likely in view of that agency's "spread-out" buying policies.

The return of confidence and interest in the market late in the month was almost entirely due to the last-minute action of Congress on three bills, all vitally important to the market. The first of these measures was the restoration of almost all the funds cut from ECA by the House Appropriations Committee. The second was the approval of the $150,000,000 revolving fund which will provide for the shipment of cotton to areas occupied by the Army. The third measure was the adoption of a farm bill which will provide for a loan of 90% of parity for the 1949-1950 crop cotton.

The 15/16 inch middling spot price was 38.83¢ on June 1, reached the monthly high of 39.13¢ on June 2, declined and fluctuated in the 37.00-38.50¢ range during most of the month, and closed at 36.89¢ on June 30. September futures prices showed the same movement as spot prices, although to a somewhat lesser degree. September futures were 34.79¢ at the start of June, reached the peak of 34.97¢ on June 2, and closed the month at 33.54¢.

**Fabrics**

The cotton gray goods market continued its relatively quiet tone during June. Drills and twills were generally slow, with most business being done in small lots for third-quarter delivery. Some observers saw signs of shakiness in drill and twill prices that might result in price revisions in the near future. The osnaburg market was virtually at a standstill during the early part of June. Toward the middle of the month producers reduced osnaburg prices and attracted substantial business. The 40-inch 40x26 2.11 yard goods dropped from 25¢ to 24¢, while the 40-inch 32x28 3.65 yard cloth went from 18¢ to 17¢.

Some nearby business in sheetings developed in fairly small volumes, but most numbers remained in the doldrums, and prices continued weak in some constructions. Following a period of fair activity in chafer fabrics during the first week in June, trading in these goods tapered off. A moderate amount of the chafer fabrics sold were for August delivery, but the tire trade was said to be pretty well covered for all nearby deliveries.

Hose and belting ducks moved in small quantities and were priced at 68.50¢; while all numbered ducks continued to be quoted at 39% off the list price. Enameling ducks moved slowly, with most sales being made in the wide 72-inch construction to the pipe-covering trade.

## United States Rubber Statistics—March, 1948

(All Figures in Long Tons, Dry Weight)

| | | New Supply | | | Distribution | | |
|---|---|---|---|---|---|---|---|
| | | Production | Imports | Total | Consumption | Exports | Stocks |
| Natural rubber, total | | 0 | 68,877 | 68,877 | 52,259 | 467 | 122,243 |
| Natural latex, total | | 0 | 3,193 | 3,193 | 2,185 | 0 | 8,052 |
| Natural rubber and latex, total | | 0 | 72,070 | 72,070 | 54,444 | 467 | 130,295 |
| Synthetic rubber, total | * | 42,396 | 1,769 | 45,709 | 38,222 | 383 | 72,885 |
| | † | 1,544 | | | | | |
| GR-S | * | 35,620 | 1,769 | 37,877 | 29,721 | 8 | ‡50,432 |
| | † | 488 | | | | | |
| Butyl | * | 4,366 | 0 | 4,366 | 4,748 | 3 | 14,490 |
| Neoprene | * | 2,410 | 0 | 3,086 | 3,204 | 350 | 5,322 |
| | † | 676 | | | | | |
| Nitrile | † | 380 | 0 | 380 | 549 | 22 | 2,641 |
| Natural rubber and latex, and synthetic rubber, total | | 43,940 | 73,839 | 117,779 | 92,666 | 850 | 203,180 |
| Reclaimed rubber, total | | 24,089 | 0 | 24,089 | 24,362 | 937 | 38,313 |
| GRAND TOTALS | | 68,029 | 73,839 | 141,868 | 117,028 | 1,787 | 241,493 |

* Government plant production.
† Private plant production.
‡ Includes 29 long tons shipped for export, but not cleared.
SOURCE: Rubber Division, OMD, United States Department of Commerce.

# DAY RUBBER DISSOLVERS

**TURBINE TYPE**

**300 Gallon dissolver with vertical motor drive**

The wide range of viscosities which this dissolver will handle, together with a variety in design of the agitator, provides a wide range of applications. When extreme violent mixing action is required, they are equipped with diffusion rings insuring adequate mixing action in the shortest possible time.

Built in working capacities of 80, 150, and 300 gallons.

**THE J. H. DAY CO.**

**CINCINNATI 22, OHIO**

**Regular and Special Constructions of**

## COTTON FABRICS

**Single Filling** **Double Filling**

**and**

**ARMY**

# Ducks

**HOSE and BELTING**

# Ducks

# Drills

**Selected**

# Osnaburgs

# Curran & Barry

**320 BROADWAY**

**NEW YORK**

# Malayan Rubber Statistics

The following statistics for April, 1948, have been received from Singapore by way of Malaya House, (57 Trafalgar Square, London, W. C. 2, England.

### Ocean Shipments from Singapore and Malayan Union—In Tons

| To | Sheet and Crepe | | | Latex, Concentrated Latex, and Revertex (Dry Rubber Cement) | | |
|---|---|---|---|---|---|---|
| | Singapore | Malayan Union | | Singapore | Malayan Union | |
| | Export Proper | Trans-shipped | Direct Shipments | Export Proper | Trans-shipped | Direct Shipments |
| Argentine Republic | 1 | 75 | 75 | ... | ... | ... |
| Australia | 2,791 | 220 | 485 | 51 | 17 | ... |
| Belgium | 210 | 44 | 1,132 | ... | 89 | 2 |
| Canada | 1,618 | 400 | 1,516 | ... | ... | ... |
| Chile | ... | ... | 2 | ... | ... | ... |
| China | 626 | ... | ... | ... | ... | ... |
| Czechoslovakia | 420 | ... | 350 | ... | ... | ... |
| Denmark | 4 | 1 | 344 | 16 | ... | ... |
| Egypt | 23 | ... | 8 | ... | 1 | ... |
| Finland | 25 | ... | 390 | ... | ... | ... |
| Formosa | 545 | ... | ... | ... | ... | ... |
| France | 1,844 | 29 | 1,587 | 187 | 85 | 66 |
| Germany | 1,484 | 205 | 3,297 | ... | ... | ... |
| Hong Kong | 1,938 | 6 | 384 | ... | ... | ... |
| Iraq | 5 | ... | ... | ... | ... | ... |
| Italy | 264 | 77 | 1,281 | 31 | 16 | 17 |
| Japan | 50 | 125 | 1,530 | ... | ... | ... |
| Mexico | 367 | ... | 704 | ... | 9 | ... |
| Netherlands | 175 | ... | 272 | 12 | 10 | 18 |
| New Zealand | 381 | 66 | ... | 3 | 6 | ... |
| Norway | ... | ... | 172 | 4 | 4 | ... |
| Other countries in South America | 30 | 1 | ... | ... | ... | ... |
| Palestine | 1 | ... | ... | ... | ... | ... |
| Portugal | ... | ... | 22 | ... | ... | ... |
| Russia | 100 | ... | 4,151 | ... | ... | ... |
| Siam | ... | ... | 75 | ... | ... | ... |
| Sweden | 65 | 16 | 162 | ... | ... | ... |
| Switzerland | 68 | ... | ... | ... | ... | ... |
| Syria | 10 | ... | ... | ... | ... | ... |
| Turkey | 5 | ... | 140 | ... | ... | ... |
| Union of South Africa | 843 | 181 | 200 | 1 | 15 | ... |
| United Kingdom | 2,109 | 1,206 | 4,588 | 548 | 39 | 133 |
| U. S. A. | 9,544 | 1,523 | 12,612 | 514 | 25 | 436 |
| TOTAL | 25,546 | 4,175 | 35,389 | 1,367 | 316 | 672 |

### Foreign Imports of Rubber in Long Tons

| Singapore Imports from | Dry Rubber | Wet Rubber (Dry Weight) |
|---|---|---|
| Brunei | 161 | 5 |
| Dutch Borneo | 1,530 | 95 |
| French Indo-China | ... | 50 |
| Java | *1,670 | ... |
| North Borneo | 1,049 | 52 |
| Other Dutch Islands | 47 | 2 |
| Rhio Residency | 666 | 38 |
| Sarawak | 2,988 | 1 |
| Sumatra | 8,647 | 4,415 |
| TOTAL | 16,758 | 4,658 |

*Includes 23 tons sole crepe.

| Federation of Malaya Imports from | | |
|---|---|---|
| Burma | 376 | 46 |
| Siam | 240 | 26 |
| Sumatra | 854 | 784 |
| TOTAL | 1,470 | 856 |

### Dealers Stocks

| | Tons |
|---|---|
| Singapore | 54,635 |
| Penang & Province Wellesley | 15,445 |
| TOTAL | 70,080 |

### Port Stocks in Private Lighters and Railway Godowns

| | |
|---|---|
| Penang & Province Wellesley | 6,592 |
| Port Dickson | 200 |
| Port Swettenham | 11,981 |
| Singapore | 11,361 |
| Teluk Anson | 270 |
| TOTAL | 30,404 |

### Production

| | |
|---|---|
| Estate | 32,724 |
| Small holdings (estimated) | 33,684 |
| TOTAL | 66,408 |

## Shipments and Consumption of Plastics and Resins

The following statistics represent the shipments and consumption, in pounds, of plastics and synthetic resins for the first quarter of 1948 and the full year 1947, as reported to the Bureau of the Census, United States Department of Commerce, by 84 manufacturing companies and company departments for March, and 83 companies and departments for the other periods covered herein. Data on synthetic resins for protective coatings are not included.

| | January | February | March | 1947 Totals |
|---|---|---|---|---|
| Cellulose acetate and mixed ester plastics* | 5,746,104 | 5,054,580 | 5,313,837 | 77,446,471 |
| Nitrocellulose plastics* | 865,389 | 929,881 | 991,170 | 12,885,511 |
| Other cellulose plastics*† | 746,816 | 651,637 | 768,754 | ‡1,685,554 |
| Phenolic and other tar acid resins: | | | | |
| Laminating (dry basis) | 3,389,537 | 3,159,761 | 3,611,012 | 40,546,186 |
| Adhesives (dry basis) | 1,737,741 | 1,790,826 | 1,928,026 | 21,069,109 |
| Molding materials* | 18,338,089 | 17,370,124 | 19,715,665 | 193,969,462 |
| All other (dry basis)† | 5,283,795 | 4,379,839 | 5,339,198 | 63,455,641 |
| | 28,749,162 | 26,700,550 | 30,593,901 | 319,040,398 |
| Urea and melamine resins: | | | | |
| Adhesives (dry basis) | 4,596,974 | 4,183,184 | 5,200,142 | 48,553,622 |
| Textile and paper treating (dry basis) | 1,671,182 | 1,737,401 | 1,221,908 | 15,948,902 |
| All other, including laminating (dry basis)†§ | 555,516 | 851,538 | 694,366 | 9,789,063 |
| | 6,822,672 | 6,772,123 | 7,116,416 | 74,291,587 |
| Polystyrene†¶ | 10,226,219 | 8,382,160 | 12,717,696 | 94,990,618 |
| Vinyl resins: | | | | |
| Sheeting and film* | 7,784,527 | 5,980,191 | 7,537,151 | 66,425,689 |
| Textile and paper coating (resin content) | 2,414,438 | 2,102,156 | 3,053,490 | 17,235,802 |
| Molding and extrusion (resin content) | 7,823,309 | 7,601,313 | 6,767,151 | 73,113,506 |
| All other, including adhesives (resin content)† | 1,531,470 | 1,950,604 | 1,679,557 | 27,062,369 |
| | 19,553,744 | 17,634,264 | 19,037,349 | 183,837,465 |
| Miscellaneous plastics and resins*†‖ | 7,676,956 | 7,799,601 | 8,639,313 | 85,978,117 |
| TOTALS | 80,386,801 | 73,924,796 | 85,186,436 | 850,155,721 |

*Includes fillers, plasticizers, and extenders.
† Excludes data for protective coating resins.
‡ Includes data for only four months of 1947.
§ Urea and melamine molding materials are included with miscellaneous molding materials.
¶ Dry basis, including necessary coloring materials.
‖ Includes data for urea, melamine, acrylic acid, and miscellaneous molding materials, petroleum resins, acrylic acid ester resins, resin mixtures, and miscellaneous synthetic materials.

**Fluorescent Lighting Fixture with Decorative Plastic Shield**

## Plastic Shield for Lighting Fixtures

A NEW line of plastic shielded, modern, fluorescent fixtures, designed to light and decorate every room in the house, is being made by Markstone Mfg. Co., Chicago, Ill. In this fixture, light is softly diffused through a ribbed plastic shield that fully encloses the fixture and prevents dust or insects from collecting inside.

Manufactured by United States Rubber Co., Rockefeller Center, New York, N. Y., the plastic shield is said to be light in weight, shatter-proof, unaffected by normal temperature changes, easily cleaned with soap and water, and will not discolor with age. The shields are made in attractive patterns, both in soft monotones for the living room, dining room, bedroom, bathroom, and den, and in bright colors for the kitchen and breakfast nook. A gay children's pattern is also available for the nursery and playroom.

The decorative effect of the fixture is further enhanced by rich color trims at each end, available in jeweler's gold, chrome, rose, blue, and Chinese red. The fixtures vary in length from 17 to 50 inches. They can be easily installed by home owners, either by attaching to a standard ceiling light holder or by mounting flush with the ceiling.

# CLASSIFIED ADVERTISEMENTS

*ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE*

**Effective July 1, 1947**

| GENERAL RATES | SITUATIONS WANTED RATES | SITUATIONS OPEN RATES |
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| Light face type $1.25 per line (ten words) | Light face type 40c per line (ten words) | Light face type $1.00 per line (ten words) |
| Bold face type $1.60 per line (eight words) | Bold face type 55c per line (eight words) | Bold face type $1.40 per line (eight words) |
| *Allow nine words for keyed address.* | | *Replies forwarded without charge* |

**Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.**

## SITUATIONS WANTED

CONSULTING WORK: CHEMISTRY, PHYSICS, ENGINEERING, organization, by an experienced CONSULTING ENGINEER. Address Box No. 142, care of INDIA RUBBER WORLD.

**RUBBER CHEMIST, Sc.B., SEVERAL YEARS' EXPERIENCE formulation and evaluation natural and synthetic rubber compounds for electrical goods, desires position with future. Details and references on request. East preferred. Single. Address Box No. 143, care of INDIA RUBBER WORLD.**

RUBBER TECHNOLOGIST, Ch.E., NINE YEARS' EXPERIENCE in sponge, soling, and reclaiming with crudes and synthetics. Desires position with future in development or technical sales. Married. Age 35. Address Box No. 144, care of INDIA RUBBER WORLD.

**CONNECTION WANTED WITH TIRE MANUFACTURING COMpany. Have 30 years' experience in experimental work specializing in air bags. Have my own patentable never-leak valve. Address Box No. 145, care of INDIA RUBBER WORLD.**

REGISTERED MECHANICAL ENGINEER: THOROUGHLY EXperienced in the product design of hose and V-belts. Specializing in the organization and maintenance of production specifications, quality control procedures, cost figuration, and technical sales service. Presently employed, but desires a position with a greater future. Thirteen years in the Rubber Industry. Address Box No. 146, care of INDIA RUBBER WORLD.

CHEMICAL ENGINEER WITH MANAGEMENT EXPERIENCE in the following: 1. Molded and extruded goods; 2. chemicals production; 3. plastic flooring; 4. sales and market development of plastic films, coated fabrics, rubber chemicals. Additional experience in market research, development cost studies, government contacts. Desires responsible position with forward-looking organization in development, production, or technical sales. Salary upper bracket; location immaterial. Address Box No. 161, care of INDIA RUBBER WORLD.

TIRE CHEMIST—FIVE YEARS' EXPERIENCE IN COMpounding and processing, development of new recipes, raw material control, curing specifications, and factory testing of new materials. Age 35; college graduate; married. Address Box No. 163, care of INDIA RUBBER WORLD.

RUBBER CHEMIST, 31, EXPERIENCED HARD, SOFT RUBBER, latex. Desires supervisory position. Address Box No. 164, care of INDIA RUBBER WORLD.

TECHNICAL SALESMAN, Ch.E., 28, 5 YEARS' EXTENSIVE EXperience in sales, product development, research of water emulsions and solvent solutions of natural, synthetic, reclaimed rubbers, vinyl polymers for adhesives, coatings, saturants, binders; dip compounds. Desires responsible position. Address Box No. 165, care of INDIA RUBBER WORLD.

## SITUATIONS OPEN

EXPERIENCED RUBBER MAN ESPECIALLY ON AUTOMOtive small rubber goods wanted. One who has experience in this line and can take charge of rubber room and do his own compounding. Address Box No. 147, care of INDIA RUBBER WORLD.

LATEX CHEMIST. OPENING IN SALES SERVICE LABORAtory for experienced latex chemist. Eastern seaboard. Give educational and industrial experience. Replies confidential. Address Box No. 148, care of INDIA RUBBER WORLD.

## SITUATIONS OPEN (Continued)

### *FACTORY MANAGER—LATEX DIPPING*

**Established manufacturer in New Jersey (near New York City) has opening for plant manager; must be entirely familiar and have extensive experience in latex compounding and dipping. Exceptional opportunity for right party. Write in detail past experience and salary expected; state age. All Replies will be kept in strict confidence. Address Box No. 158, care of India RUBBER WORLD.**

WANTED: DIRECTOR OF PURCHASES. MUST HAVE THORough knowledge of fabrics, heavy industrial equipment, and material requirements. Location, eastern seaboard. If interested, give complete resumé in first reply. Company offering this position has excellent ratings. Salary commensurate with ability. Address Box No. 149, care of INDIA RUBBER WORLD.

LATEX CHEMIST WITH PRACTICAL EXPERIENCE OF ALL dipped goods for company operating in Australia and New Zealand. Modern factory, excellent prospects. Suitable man will be offered shareholding in company. Address Box No. 150, care of INDIA RUBBER WORLD.

MIDWEST MANUFACTURER DESIRES EXPERIENCED MAN for coating fabrics and manufacturing rainwear. State age, education, reference. Answers held in confidence. Address Box No. 151, care of INDIA RUBBER WORLD.

ALERT AND AMBITIOUS YOUNG CHEMIST WITH SOME compounding experience in molded rubber goods for nationally-known organization. Unusual opportunity for man who can fill this job. State age, education, experience, present earnings. All replies strictly confidential. Address Box No. 152, care of INDIA RUBBER WORLD.

WANTED: A RUBBER CHEMIST OR CHEMICAL ENGINEER with at least five years' experience in rubber production and rubber development work. To work out of the Sales Department of a Central Michigan Chemical Manufacturer. Give full particulars of education, experience, etc. Address Box No. 159, care of INDIA RUBBER WORLD.

MAN NEEDED FOR JOB OF SUPERVISING THE OPERATION of the stock mixing and calender departments of a small Western Plant. Answer stating experience, qualifications, and salary desired. Address Box No. 160, care of INDIA RUBBER WORLD.

WANTED: THOROUGHLY EXPERIENCED MAN NEEDED WHO is capable of taking charge of a cotton hose manufacturing department in a medium-sized manufacturing plant. Apply giving details of experience and wages wanted. Address Box No. 162, care of INDIA RUBBER WORLD.

WANTED: CHEMIST WITH SOME PRACTICAL EXPERIENCE in rubber compounding on mechanical goods, flooring, soling, and toys, together with some knowledge of following through with factory controls. Replies confidential. Address Box No. 166, care of INDIA RUBBER WORLD.


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## Dominion of Canada Statistics

### Imports of Crude and Manufactured Rubber

| | April, 1948 | | April, 1947 | |
|---|---|---|---|---|
| UNMANUFACTURED | Quantity | Value | Quantity | Value |
| Balata ..... lbs. | 25 | $ 101 | 669 | $ 2,410 |
| Crude rubber ..... | 9,994,844 | 1,851,502 | 9,754,635 | 2,012,016 |
| Gutta percha ..... | ..... | ..... | 8,623 | 3,813 |
| Latex ..... lbs. | 333,461 | 125,042 | 149,663 | 50,809 |
| Rubber, powdered and waste ..... lbs. | 278,000 | 11,260 | 1,855,400 | 37,184 |
| Recovered ..... lbs. | 2,069,000 | 165,806 | 2,009,500 | 157,200 |
| Synthetic and substitute ..... lbs. | 60,800 | 15,308 | 481,900 | 113,972 |
| TOTALS ..... | 12,736,130 | $2,169,019 | 14,260,390 | $2,377,404 |
| PARTLY MANUFACTURED | | | | |
| Comb blanks of hard rubber ..... | ..... | $ 1,112 | ..... | $ 1,415 |
| Hard rubber in rods or tubes ..... lbs. | 593 | 810 | 1,725 | 1,783 |
| Rubber thread, not covered ..... lbs. | 12,345 | 18,389 | 7,550 | 6,764 |
| TOTALS ..... | 12,938 | $ 20,231 | 9,225 | $ 9,962 |
| MANUFACTURED | | | | |
| Bathing shoes ..... | 7,364 | 3,637 | 6,566 | $ 3,133 |
| Belting ..... | ..... | 93,491 | ..... | 58,764 |
| Boots and shoes of rubber, n.o.p. ..... prs. | 12,491 | 18,935 | 82,512 | 114,406 |
| Canvas shoes with rubber soles ..... prs. | 549 | 578 | 1,895 | 3,146 |
| Cement ..... | ..... | 38,824 | ..... | 51,211 |
| Clothing of waterproofed cotton or rubber ..... | ..... | 3,300 | ..... | 6,697 |
| Druggists' sundries ..... | ..... | 48,016 | ..... | 54,614 |
| Gaskets and washers ..... | ..... | 38,641 | ..... | 33,801 |
| Gloves ..... doz. prs. | 855 | 2,709 | 1,411 | 5,351 |
| Golf balls ..... doz. | 2,134 | 9,284 | 298 | 1,397 |
| Heels ..... prs. | 27,400 | 4,582 | 16,531 | 1,641 |
| Hose ..... | ..... | 43,761 | ..... | 49,887 |
| Hot water bottles ..... | ..... | 2,706 | ..... | 5,076 |
| Inner tubes, n.o.p. ..... no. | 1,011 | 2,556 | 3,399 | 9,623 |
| Bicycle ..... no. | 20,697 | 8,940 | 1,638 | 1,035 |
| Liquid sealing compound ..... | ..... | 3,513 | ..... | 1,926 |
| Mats and matting ..... | ..... | 43,147 | ..... | 55,096 |
| Nursing nipples ..... gross | 2,247 | 9,440 | 374 | 2,076 |
| Packing ..... | ..... | 20,854 | ..... | 9,841 |
| Raincoats ..... no. | 550 | 5,502 | 387 | 1,549 |
| Tires, pneumatic, n.o.p. ..... no. | 2,814 | 103,192 | 16,257 | 228,249 |
| Bicycle ..... no. | 6,729 | 10,112 | 2,231 | 2,459 |
| Solid for automobile and motor trucks ..... no. | 54 | 1,352 | 7 | 139 |
| Other ..... | ..... | 2,694 | ..... | 3,261 |
| Tire repair material ..... | ..... | 8,461 | ..... | 28,141 |
| Other rubber manufactures ..... | ..... | 410,095 | ..... | 361,731 |
| TOTALS ..... | ..... | $ 938,322 | ..... | $1,094,340 |
| TOTAL RUBBER IMPORTS ..... | ..... | $3,127,662 | ..... | $3,481,706 |

### Exports of Crude and Manufactured Rubber

| | | | | |
|---|---|---|---|---|
| UNMANUFACTURED | | | | |
| Crude rubber ..... lbs. | 1,601,996 | $ 303,278 | 1,826,866 | $ 340,733 |
| Waste rubber ..... lbs. | 1,135,900 | 10,302 | 901,300 | 11,053 |
| TOTALS ..... | 2,737,896 | $ 313,580 | 2,728,166 | $ 351,786 |
| PARTLY MANUFACTURED | | | | |
| Soling slabs of rubber .. lbs. | 2,700 | $ 570 | 25,276 | $ 6,320 |
| MANUFACTURED | | | | |
| Bathing caps ..... | ..... | $ ..... | ..... | $ 180 |
| Belting, n.o.p. ..... lbs. | 334,622 | 232,667 | 334,330 | 224,965 |
| Belts, fan ..... | ..... | 972 | ..... | 2,147 |
| Boots and shoes of rubber, n.o.p. ..... prs. | 145,439 | 200,588 | 186,741 | 300,204 |
| Canvas shoes with rubber soles ..... prs. | 26,279 | 22,850 | 118,614 | 116,638 |
| Clothing of rubber and waterproofed clothing ... | ..... | 21,911 | ..... | 15,643 |
| Heels ..... | 3,792 | 299 | 234,054 | 19,298 |
| Hose ..... | ..... | 78,974 | ..... | 50,414 |
| Inner tubes for motor vehicles ..... no. | 46,275 | 114,998 | 56,058 | 140,836 |
| Soles ..... prs. | 1,592 | 358 | 27,788 | 6,394 |
| Tires, pneumatic for motor vehicles .... no. | 50,886 | 1,108,649 | 43,933 | 778,792 |
| Other ..... no. | 456 | 809 | 8,002 | 7,024 |
| Wire and cable, copper, insulated ..... | ..... | 158,397 | ..... | 238,824 |
| Other rubber manufactures ..... | ..... | 27,131 | ..... | 41,656 |
| TOTALS ..... | ..... | $1,968,603 | ..... | $1,943,015 |
| TOTAL RUBBER EXPORTS ..... | ..... | $2,282,753 | ..... | $2,301,121 |

**"Rayon Cord Opens the Door to a New Era in Tires."** Industrial Rayon Corp., Cleveland 1, O. 20 pages. This booklet, illustrated with cartoons, photographs, and a flow chart, reviews the story of tire development, the place of rayon cord in tires, basic differences between rayon and natural fibers, rayon superiority in tire performance, the making of the company's Tyron rayon tire cord, and the use of Tyron in tires.

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FOR SALE: BAKER-PERKINS 200-GAL. & 100-GAL. DOUBLE-arm jack. Mixers, also 50, 20, 9 & Lab. 0.7 gals.; Royle #2 Perfected Extruder; Thropp 16" x 36", 2-Roll Rubber Mill, also Lab. size, 30", 36", 40", 42", 48", 60", 84" sizes; Rubber Calenders 30", 54", & 60"; Rubber Tubers 2" to 6"; Large stock Hydraulic Presses from 12" x 12" to 42" x 48" platens, from 50 to 500 tons; Hydraulic Pumps & Accumulators; H.P.M. 4-oz. Injection Molding Machine, other sizes 1 to 16 oz.; Stokes & Colton single punch & rotary Preform Tablet Machines, ½" to 2"; Banbury Mixers; Kettles; Tanks; Rotary Cutters; Grinders & Crushers; Mixers; Pumps; etc.

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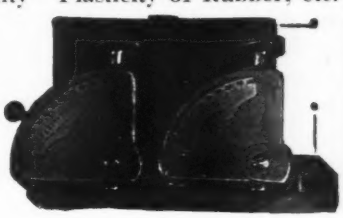

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ONE THROPP RUBBER MILL 18½" X 42", EQUIPPED WITH guide, safety brake, catch pan, etc. Must be in good condition. Give full particulars, price, location, etc. Address Box No. 167, care of INDIA RUBBER WORLD.

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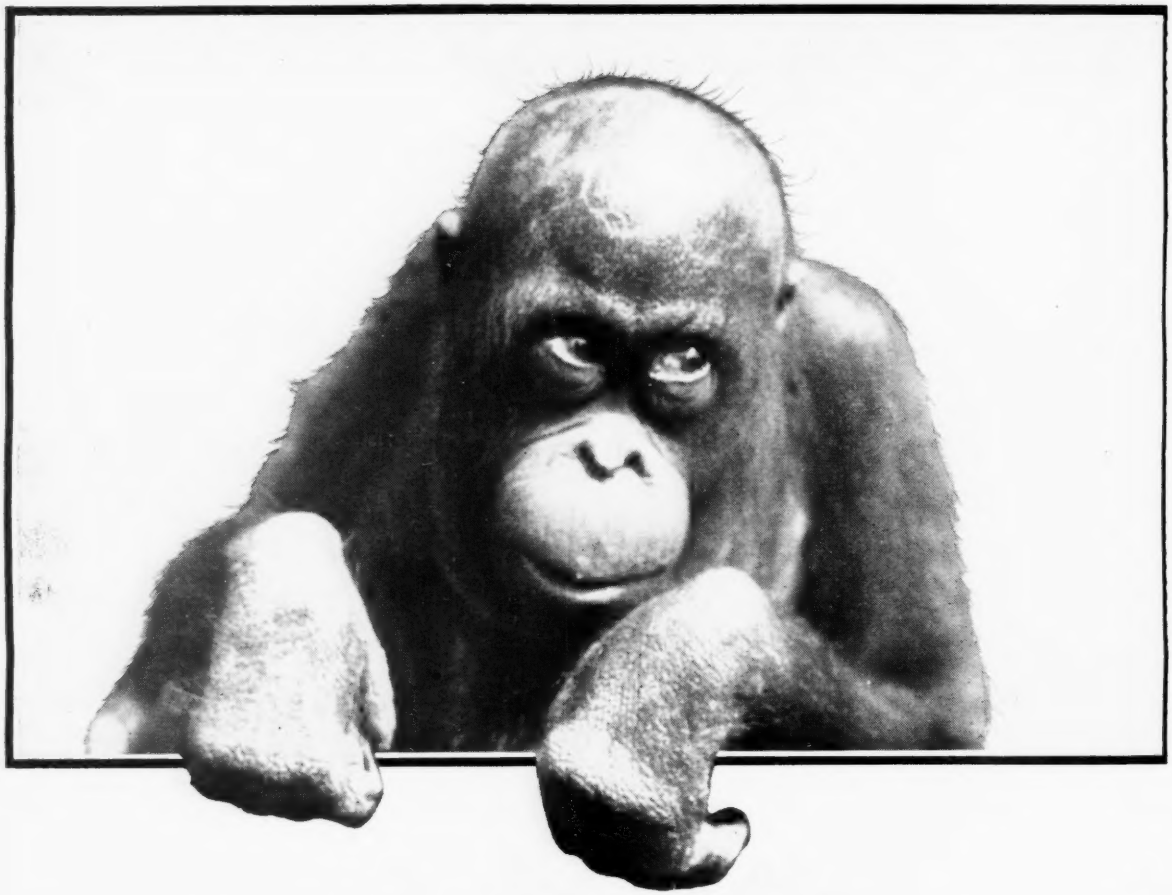

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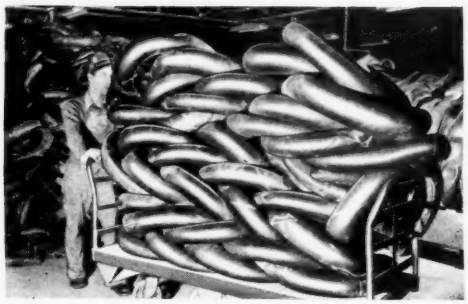

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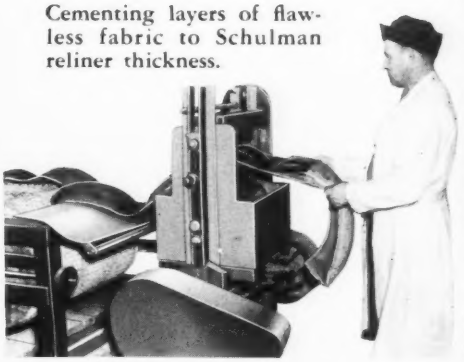

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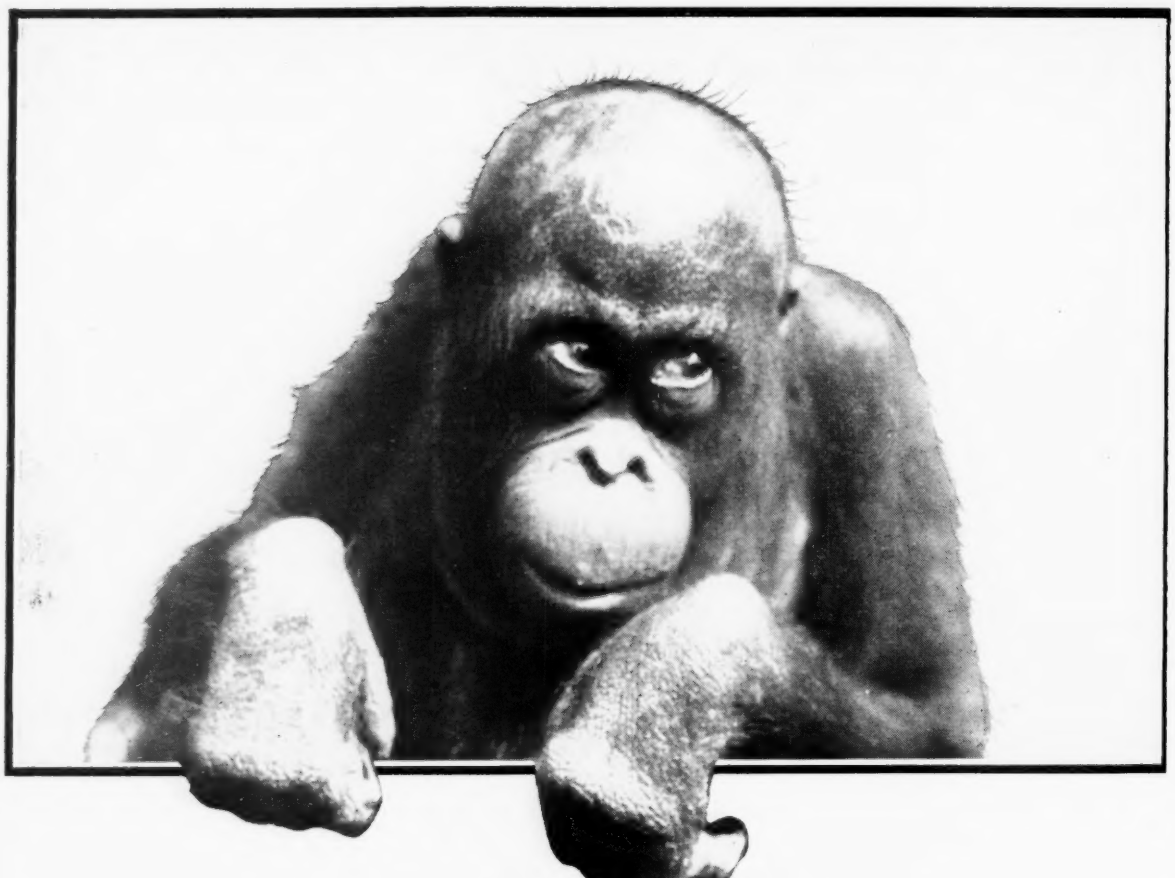

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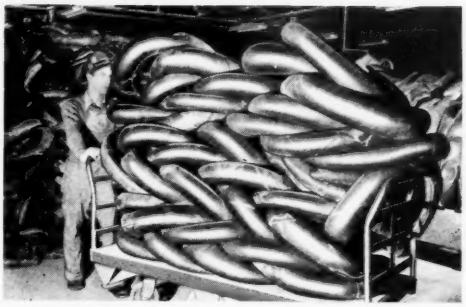

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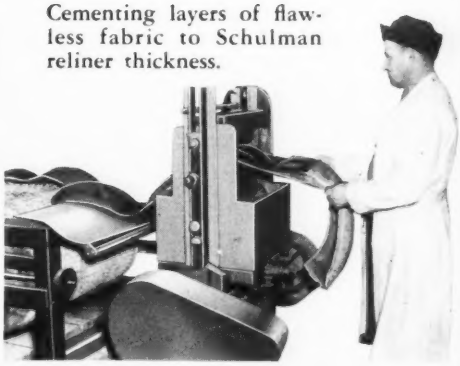

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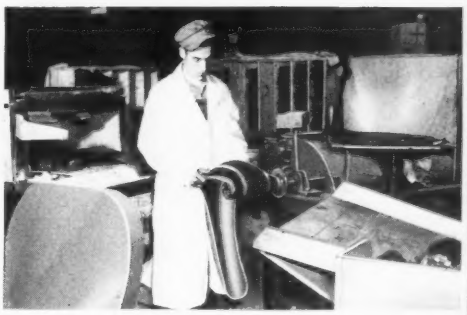

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